SVM146-A

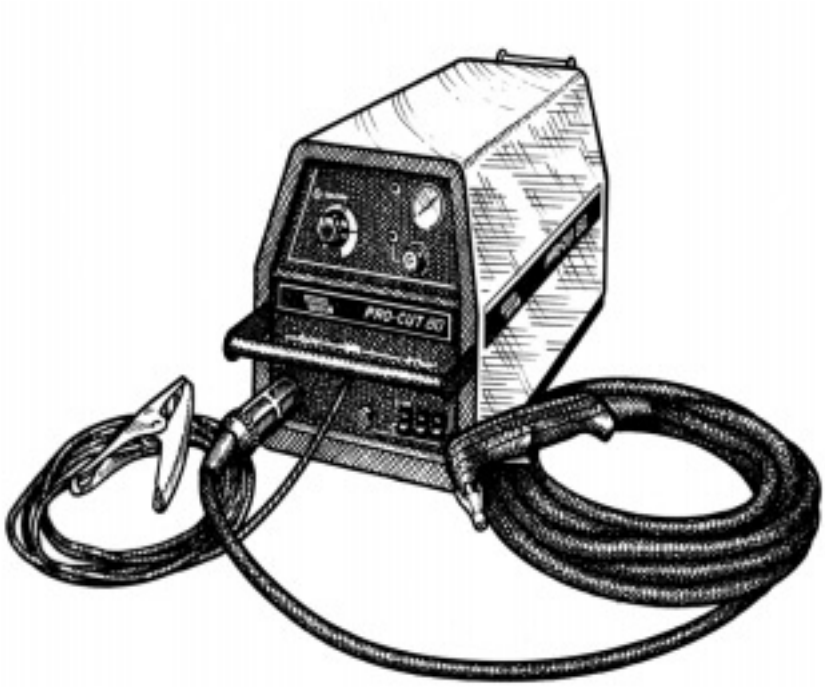
September, 1999

PRO-CUT™ 80

For use with machine code numbers **10573, 10574, 10577, 10578**

Safety Depends on You

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation . . . and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.** And, most importantly, think before you act and be careful.



SERVICE MANUAL

LINCOLN® ELECTRIC

• World's Leader in Welding and Cutting Products •

• Sales and Service through Subsidiaries and Distributors Worldwide •

Cleveland, Ohio 44117-1199 U.S.A. TEL: 216.481.8100 FAX: 216.486.1751 WEB SITE: www.lincolnelectric.com

SAFETY

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Gasoline Engines

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of “Safety in Welding & Cutting - ANSI Standard Z49.1” from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of “Arc Welding Safety” booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

SAFETY

ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- **Semiautomatic DC Constant Voltage (Wire) Welder.**
- **DC Manual (Stick) Welder.**
- **AC Welder with Reduced Voltage Control.**

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and below Threshold Limit Values (TLV) using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

5.b. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.c. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.d. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer’s safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.e. Also see item 1.b.

SAFETY

WELDING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to “Safety in Welding and Cutting” (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

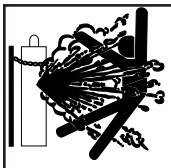
6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances”, AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.



CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-l, “Precautions for Safe Handling of Compressed Gases in Cylinders,” available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer’s recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer’s recommendations.

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:
   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enroule le câble-électrode autour de n'importe quelle partie du corps.
3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:
   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnementde l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.
4. Des gouttes de laiter en fusion sont émises de l'arc de soudage. Se protéger avec es vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.
5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.
6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir ttout risque d'incendie dû étincelles.
7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.
8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de la faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou atres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.
9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumées toxiques.
10. Ne pas souder en présence de vapeurs de chlore provenant d'opéerations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement roxique) ou autres produits irritants.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.
2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.
3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.
4. Garder tous les couvercles et dispostifis de sûreté à leur place.

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INSTALLATION

TECHNICAL SPECIFICATIONS - PRO-CUT 80

INPUT RATINGS		
Single Phase Input Voltage and Hertz	**Input Currents**	**Rated Output Amps**
208/1/60	87	80
230/1/60	81	80
460/1/60	48	80
Three Phase Input Voltage and Hertz	**Input Currents**	**Rated Output Amps**
208/3/60	48	80
230/3/60	44	80
460/3/60	25	80

IDLE CURRENT AND WATTS		
230/1/60	0.61 Amps	140 Watts

RATED OUTPUT	
Duty Cycle	**Rated Output Amps**
60%	80
100%	60

OUTPUT		
Current Range	**Open Circuit Voltage**	**Pilot Current**
35 - 85 Amps	335VDC Maximum	20 Amps @ 100% Duty Cycle

INSTALLATION

TECHNICAL SPECIFICATIONS (Cont'd) - PRO-CUT 80

GAS REQUIREMENTS

Required Gas Flow Rate	Required Gas Inlet Pressure
70 PSI @ 480 SCHF (4.8 Bar. @ 13550 LHR)	80 to 150 PSI (5.4 Bar. to 10.2 Bar.)

RECOMMENDED INPUT WIRE AND FUSE SIZES

For all plasma cutting applications based on U.S. National Electrical Code
Ambient Temperature 30°C or Less

AC Input Voltage at 60 Hertz	Fuse (Super Lag) Circuit Breaker (Delay Type)	Type 75°C Copper Wire in Conduit AWG (IEC) Sizes	
230VAC Single Phase	100 Amps	#4 (21.1mm^2)	#4 (21.1mm^2)
460VAC Single Phase	60 Amps	#8 (8.4mm^2)	#8 (8.4mm^2)
230VAC Three Phase	60 Amps	#8 (8.4mm^2)	#8 (8.4mm^2)
460VAC Three Phase	40 Amps	#10 (5.3mm^2)	#10 (5.3mm^2)

PHYSICAL DIMENSIONS

Height	Width	Depth	Weight with Torch Cable
16.5 Inches 419 mm	13.75 Inches 349 mm	29.5 Inches 749 mm	98 lbs. (44.5 kg.) (25 ft. cable) 113 lbs. (51.4 kg.) (50 ft. cable)

INSTALLATION

Read this entire installation section before you start installation.

SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

- ¥ Turn the input power OFF at the disconnect switch or fuse box and discharge input capacitors before working inside the equipment.
- ¥ Do not touch electrically hot parts or electrodes with your skin or wet clothing.
- ¥ Always connect the 80 grounding terminal (located on the side of the Case Back Assembly) to a good electrical earth ground.
- ¥ Always wear dry, insulating gloves.
- ¥ Turn the 80 Power Switch OFF when connecting power cord to input power.

Only qualified personnel should install, use, or service this equipment.

SELECT SUITABLE LOCATION

Place the PRO-CUT 80 where clean cool air can freely circulate in through the rear louvers and out through the front/bottom opening. Dirt, dust or any foreign material that can be drawn into the machine should be kept at a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown of the machine.

A source of clean, dry air or nitrogen must be supplied to the PRO-CUT 80. Oil in the air is a severe problem and must be avoided. The supply pressure must be between 80 and 150 psi. The flow rate is approximately 6.0 cfm (170 l/min.). Failure to observe these precautions could result in excessive operating temperatures or damage to the torch.

STACKING

The PRO-CUT 80 cannot be stacked.

LIFTING AND MOVING

⚠ WARNING

FALLING EQUIPMENT can cause injury.

- ¥ Do not use the pull handle on the optional undercarriage, if installed, to lift the machine. This handle is not designed to support the full weight of the machine. Using it to lift the machine could cause personal injury or damage to the machine.
- ¥ Either the front or rear handles or both may be used to lift or move the machine.

TILTING

The PRO-CUT 80 must be placed on a stable, level surface so it will not topple over.

HIGH FREQUENCY INTERFERENCE PROTECTION

The PRO-CUT 80 employs a touch start mechanism for arc initiation. This eliminates high frequency emissions from the machine as compared with spark gap and solid state type high frequency generators. Keep in mind, though, that these machines may be used in an environment where other high frequency generating machines are operating. By taking the following steps, you can minimize high frequency interference.

- ¥ Make sure the power supply chassis is connected to a good earth ground. The work terminal ground does NOT ground the machine frame.
- ¥ Keep the work ground clamp isolated from other work clamps that have high frequency.
- ¥ If the ground clamp cannot be isolated, then keep the clamp as far as possible from other work clamp connections.
- ¥ When the machine is enclosed in a metal building, several good earth driven electrical grounds around the periphery of the building are recommended.

Failure to observe these recommended installation procedures may cause improper function of the Pro-Cut or possibly even damage the control system or power supply components.

INPUT CONNECTIONS

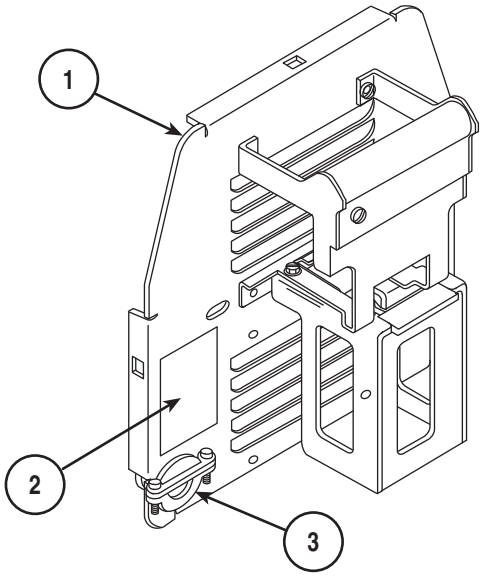
⚠ WARNING

ELECTRIC SHOCK can kill.

- ¥ Have a qualified electrician install and service this equipment.
- ¥ Turn the input power off at the fuse box before working on this equipment.
- ¥ Do not touch electrically hot parts.

Before installing the machine, check that input supply voltage, phase, and frequency are the same as the machineÕs voltage, phase, and frequency as specified on the machineÕs rating plate. See Figure A.1.

FIGURE A.1 Ð RATING PLATE LOCATION



1. CASE BACK
2. RATING PLATE
3. POWER CORD CONNECTOR WITH STRAIN RELIEF

The PRO-CUT 80 should be connected only by a qualified electrician. Installation should be made in accordance with the U.S. National Electrical Code, all local codes, and the information detailed below.

GROUND CONNECTION

The frame of the PRO-CUT 80 must be properly grounded. A ground terminal marked with the symbol ⏚ is mounted on the case bottom directly behind the input power switch for this purpose. The ground lead of the input power cord that is attached to the machine must be connected to this ground terminal. See the National Electric Code for details on proper grounding methods. Install in accordance with all local and national electrical codes.

INPUT POWER CORD CONNECTOR INSTALLATION

The PRO-CUT 80 is supplied with one 11 foot (3.35m) #8 AWG 3 lead input power cord already connected to the machine. A cord connector provides a strain relief for the input power cord as it passes through the left rear access hole. The cord connector is designed for a cord diameter of .40 - 1.03 in (10.2 - 26.2mm) if it becomes necessary to install a different input cord. See Figure A.1.

For three phase connection: Replace the input power cord with a #10 AWG 4 lead cable.

Connect the leads of the cable to a fused power panel. Make sure the green lead is connected to the panel and the panel is connected to a good earth ground.

Install in accordance with all local and national electric codes.

INPUT WIRE AND FUSE SIZE

Fuse the input circuit with the super lag fuses or delay type circuit breakers recommended on the ***Technical Specifications*** page. Choose an input and grounding wire size according to local or national codes; also see the ***Technical Specifications*** page. Using fuses or circuit breakers smaller than recommended may result in ÒnuisanceÓ shut-offs from inrush currents, even if you are not cutting at high currents.

RECONNECT PROCEDURE

When received directly from the factory, the machines are internally connected for 230 VAC. Reconnection will be necessary if a higher input voltage is used. To reconnect the Pro-Cut to 460 VAC or to connect back to 230 VAC, follow the directions as outlined below. Follow this procedure **ONLY** while the Pro-Cut is disconnected from the input power.

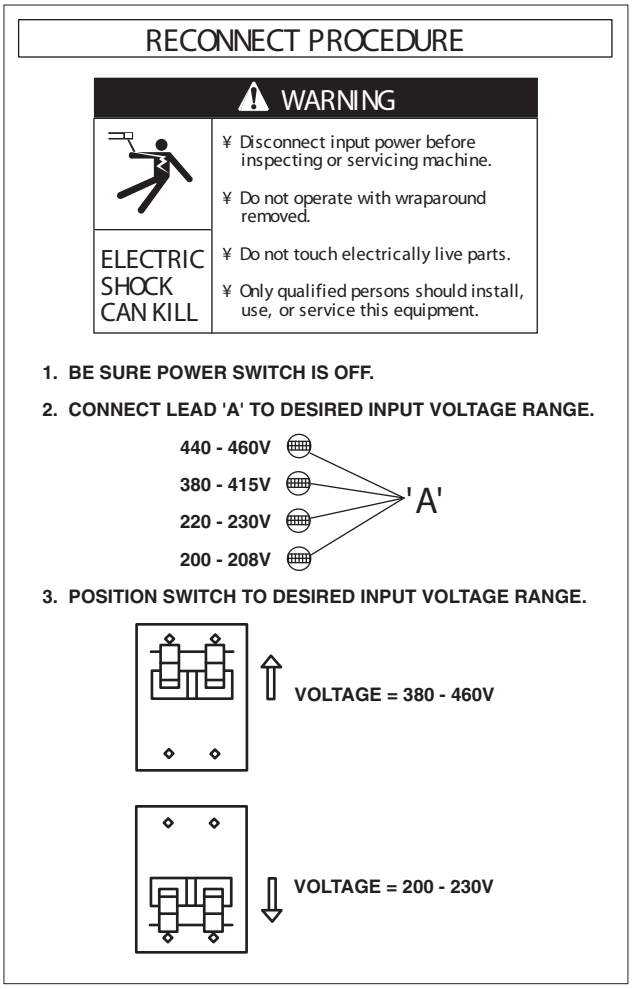
⚠ CAUTION

Failure to follow these instructions can cause immediate failure of components in the welder.

1. Open the access door on the side of the machine. Connection instructions are also included on the inside of the door.
2. For 230: Position the large switch to 200-230. See Figure A.2.

   For 460: Position the large switch to 380-460. See Figure A-2.
3. Move the ÒAÓ lead to the appropriate terminal.

FIGURE A.2 Ð RECONNECTION DIAGRAM



GAS INPUT CONNECTIONS

Supply the PRO-CUT 80 with clean compressed air or nitrogen.

- Supply pressure must be between 80 psi and 150 psi.
- Flow rate should be approximately 6.0 cfm (170 l/min.).

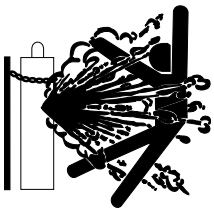
NOTE: Oil in the air supply to the PRO-CUT 80 can cause severe problems. Use only a clean air supply.

- Connect the gas supply to the PRO-CUT 80's pneumatic nipple at the air filter. See Figure A.3.
- Compressed gas should be supplied to the fitting connection mounted on the filter at the rear of the machine. If necessary, this fitting can be removed allowing plumbing access through the 1/4 in. (6.4mm) NPT input port on the filter body.

⚠ WARNING

CYLINDER could explode if damaged.

- Keep cylinder upright and chained to a fixed support.

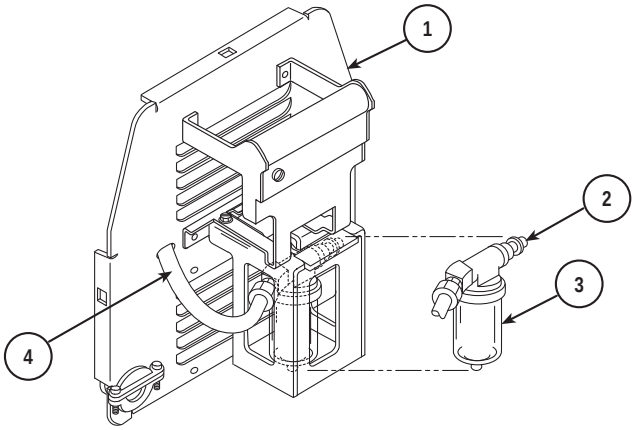


- Keep cylinder away from areas where it could be damaged.
- Never lift machine with cylinder attached.
- Never allow the cutting torch to touch the cylinder.
- Keep cylinder away from live electrical parts.
- Maximum inlet pressure 150 psi.

NOTE: When using nitrogen gas from a cylinder, the cylinder must have a pressure regulator.

- Maximum psi from nitrogen gas cylinder to PRO-CUT 80 regulator should never exceed 150 psi.
- Install a hose between the nitrogen gas cylinder regulator and the PRO-CUT 80 gas inlet.

FIGURE A.3 - COMPRESSED GAS CONNECTION



1. CASE BACK
2. PNEUMATIC NIPPLE
3. AIR FILTER
4. FLEX TUBE (TO REGULATOR INSIDE MACHINE)

OUTPUT CONNECTIONS

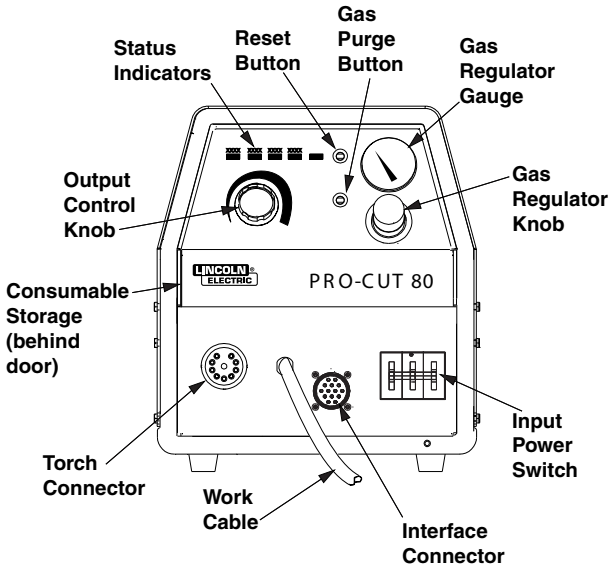
TORCH CONNECTION

The PRO-CUT 80 is supplied from the factory with a PCT 80 cutting torch. Additional cutting torches can be ordered from the K1571 series. Hand-held and mechanized torches come with 25 or 50 foot cables.

All torches are connected to the Pro-Cut with a quick connect at the case front for easy change over. See Figure A-4.

For more information on the torch and its components, refer to the PCT 80 Operator's Manual (IM595).

FIGURE A.4 - TORCH CONNECTION AT CASE FRONT



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OPERATING INSTRUCTIONS

Read and understand this entire section of operating instructions before operating the machine.

SAFETY INSTRUCTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.
- Always wear dry, insulating gloves.

FUMES AND GASES can be dangerous.

- Keep your head out of fumes.
- Use ventilation or exhaust to remove fumes from breathing zone.

CUTTING SPARKS can cause fire or explosion.

- Keep flammable material away.
- Do not cut containers that have held combustibles.

ARC RAYS can burn.

- Wear eye, ear, and body protection.

PLASMA ARC can injure.

- Keep your body away from nozzle and plasma arc.
- Operate the pilot arc with caution. The pilot arc is capable of burning the operator, others, or even piercing safety clothing.

Observe additional Safety Guidelines detailed in the beginning of this manual.

OPERATION

GENERAL DESCRIPTION

The PRO-CUT 80 is an inverter based constant current, continuous control plasma cutting power source. It provides superior and reliable starting characteristics, cutting visibility and arc stability. When cutting expanded metal, the PRO-CUT 80 out-performs the competition due to its quick, clean response to arc transfers. The power supply design provides high transfer-to-cut distances, which makes pierce cutting more reliable with less nozzle wear. The control system has a safety mechanism to insure that the nozzle and electrode are in place before cutting or gouging. This is extremely important due to the high voltages involved.

The PRO-CUT 80 comes standard with an air regulator, coarse air filter, and pressure gauge. There are six different torch and cable systems to choose from: hand-held torch with 25Õ or 50Õ cable, machine and robotic torch both with 25Õ and 50Õ cable. Consumables are included so that cutting can begin right out of the box. Consumables can also be ordered as individual packages.

The PRO-CUT 80 initiates the plasma arc with a simple, yet reliable, touch-start mechanism. This system eliminates many of the failure problems associated with hi-frequency start systems. The PRO-CUT 80 is capable of cutting with nitrogen or air.

The PRO-CUT 80 is controlled by a microprocessor-based control board. The machine performs rudimentary self troubleshooting when powered up, which aids in field servicing.

RECOMMENDED PROCESSES AND EQUIPMENT

The PRO-CUT 80 is capable of all cutting and gouging applications within its output capacity of 35 to 85 amps. These applications include thin gage sheet metal and expanded metal.

OPERATIONAL FEATURES AND CONTROLS

The PRO-CUT 80 comes with an ON/OFF POWER SWITCH, OUTPUT CURRENT CONTROL, PURGE BUTTON, STATUS INDICATORS and a SAFETY RESET BUTTON. See ***Figure B.2*** and related discussion.

DESIGN FEATURES AND ADVANTAGES

The microprocessor controlled PRO-CUT 80 design makes plasma cutting and gouging tasks uncomplicated. This list of design features and advantages will help you understand the machine's total capabilities so that you can get maximum use from your machine.

- ¥ Light weight and portable design for industrial use.
- ¥ Continuous control, 35 - 85 amps.
- ¥ Reliable touch start mechanism for plasma arc initiation.
- ¥ Unique microprocessor controlled starting sequence for safe and consistent starting.
- ¥ Rapid arc transfer for fast cutting of expanded metal.
- ¥ High transfer distance for ease of use.
- ¥ Input overvoltage protection.
- ¥ 3.0 second pilot arc.
- ¥ Purge momentary push button.
- ¥ Air regulator and pressure gauge located on the front of machine for convenience.
- ¥ ÓParts-in-PlaceÓ mechanism to detect proper installation of consumables and torch.
- ¥ Automatic detection of faulty output control.
- ¥ In-line coarse air filter.
- ¥ Preflow/Postflow timing. Preflow is eliminated if arc is re-initiated in Postflow.
- ¥ Thermostatic Protection.
- ¥ Solid state overcurrent protection.
- ¥ Works with pure nitrogen for cutting nonferrous materials.
- ¥ Reconnectable for multiple input voltages.
- ¥ Quick disconnect torch.
- ¥ Display indicators for machine status.
- ¥ Unique electrode and Vortech[a] nozzle design for optimum cooling and long life.
- ¥ Swirl texture inside Vortech[a] nozzle for better starting reliability and higher quality cuts.
- ¥ Unique drag cup design for durability and elimination of double arcing.

CUTTING CAPABILITY

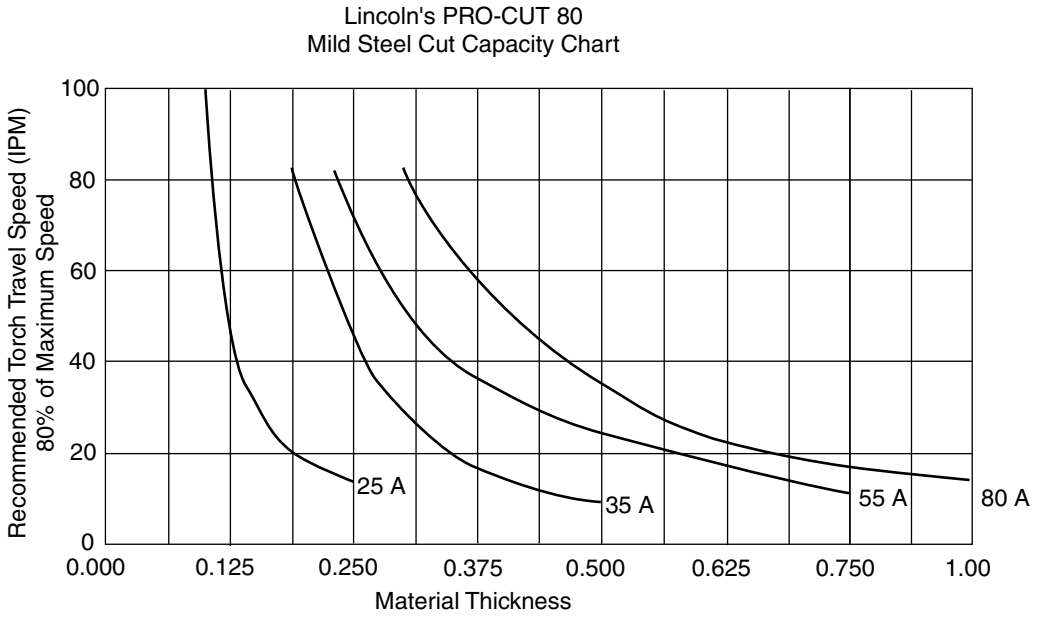
The PRO-CUT 80 is rated at 80 amps, at 60% duty cycle on a 10 minute basis or 60 amps, at 100% duty cycle. If the duty cycle is exceeded, a thermal protector will shut off the output of the machine until it cools to the normal operating temperature.

Figure B.1 shows the cut capacity of the PRO-CUT 80 when cutting mild steel. The graph plots cut thickness vs. torch travel speed with a torch standoff of 0.15 in. (3.8mm).

Example: 0.5 material

Amps	Speed (IPM)
55	25
80	35

FIGURE B.1 Đ LINCOLNÕS PRO-CUT 80 MILD STEEL CUT CAPACITY CHART



CONSUMABLE LIFE

The expected life for the PRO-CUT 80's electrode under normal operating conditions is approximately 160 starts/cuts. An erosion of .060 in. (1.5mm) is typical for end of electrode life. However, the electrode may last longer. A green and erratic arc will indicate definite electrode failure, and the electrode should be replaced immediately.

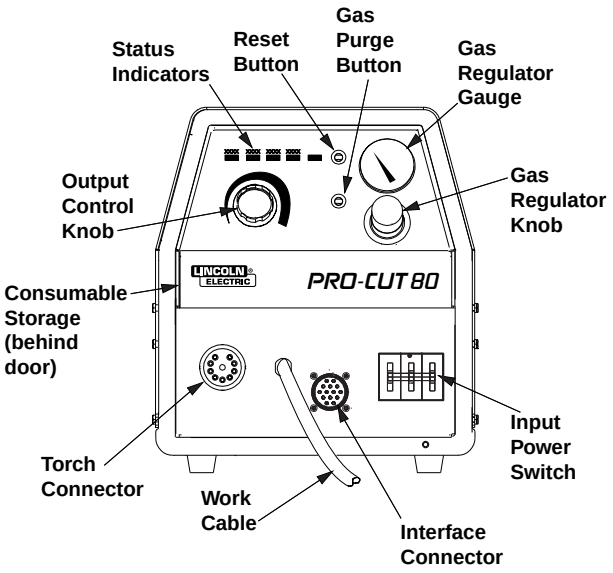
It is recommended that consumables be replaced in complete sets. (Example: Electrode and Nozzle). This will maximize the performance of the PRO-CUT 80 system.

LIMITATIONS

Do not exceed output current and duty cycle rating of machine. Do not use the PRO-CUT 80 for pipe thawing.

CONTROLS AND SETTINGS

FIGURE B.2 - CASE FRONT CONTROLS



OUTPUT CURRENT CONTROL KNOB - Adjusts the amount of cutting current applied. Affects cutting speed, dross formation, cut width, heat zone and travel speed.

TORCH CONNECTOR - Quick- connect type coupling for the PCT 80 cutting torch.

WORK CABLE - Provides clamp and cable connection to workpiece.

ON/OFF POWER SWITCH - Turns machine on or off.

GAS REGULATOR KNOB - Adjusts compressed gas pressure delivered to the torch. Length of torch hose is an adjustment factor. Optimum setting is 70-75 psi. The gas purge button must be pressed in to set pressure.

GAS REGULATOR GUAGE - Provides gas presssure reading as set by the gas regulator knob.

GAS PURGE BUTTON - Used to check or set gas pressure. Push in and hold to check pressure, then continue to hold to set the pressure. Shuts off gas when released.

RESET BUTTON - Used to reset the machine following a safety circuit trip.

STATUS (DISPLAY) BOARD INDICATORS - Four lights indicating Power, Gas Low, Thermal and Safety.

PILOT ARC CONSIDERATIONS

The Pro-Cut has a smooth, continuous pilot arc. The pilot arc is only a means of transferring the arc to the workpiece for cutting. Repeated pilot arc starts, in rapid succession, is not recommended as these starts will generally reduce consumable life. Occasionally, the pilot arc may sputter or start intermittently. This is aggravated when the consumables are worn or the air pressure is too high. Always keep in mind that the pilot arc is designed to transfer the arc to the workpiece and not for numerous starts without cutting.

When the pilot arc is started, a slight impulse will be felt in the torch handle. This occurrence is normal and is the mechanism which starts the plasma arc. This impulse can also be used to help troubleshoot a "no start" condition.

CUTTING OPERATION

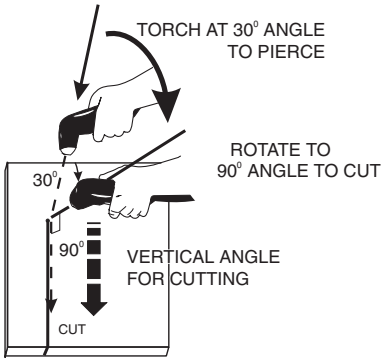
When preparing to cut or gouge, position the machine as close to the work as possible. Make sure you have all materials needed to complete the job and have taken all safety precautions. It is important to follow these operating steps each time you use the machine.

- Turn the machine's ON/OFF POWER SWITCH to the OFF position.
- Connect the air supply to the machine.
- Turn the main power and the machine power switch on.
  - The fan should start.
  - The pre-charge circuit will operate for 3 seconds, then the green "Power" status indicator should turn on.
  - If the "SAFETY" status indicator is lit, push the "Reset" button. If there is no problem, the status indicator will go off. If there is a problem, refer to ***"STATUS INDICATOR"*** in this section.
- Be sure that the work lead is clamped to the workpiece before cutting.
- Set the output current control knob for maximum current for high cutting speed and less dross formation per ***Figure B.1***. Reduce the current, if desired, to reduce the kerf (cut) width, heat affected zone or travel speed as required.
- Push-in and hold the Purge button to check or set the gas pressure. Pull the pressure regulator cap out and turn it to set the pressure.
  - Adjust the gas regulator for 70 PSI for 25 foot (7.62m) torches or 75 PSI for 50 foot (15.24m) torches.
  - Release the Purge button.

- The gas will immediately turn off. The pressure gauge may show an increase in pressure after the air turns off, but this is normal. Do NOT reset the pressure while the air is NOT flowing.

¥ When ready to cut, place the torch near the work, make certain all safety precautions have been taken and pull the trigger.
  - The air will flow for a preflow time of 2 seconds and the pilot arc will start. (This is true unless the machine is in postflow, then the preflow time is skipped and the pilot arc will start immediately.)
  - The pilot arc will run for 3 seconds and shut off unless the arc is brought in contact with the work and the arc is transferred. Avoid excessive pilot arc time by transferring the arc to the workpiece quickly to improve parts life.
  - When the arc is brought within 1/4 in. (6.4mm) from the workpiece the arc will transfer, the current will ramp up to the setting on the control panel, and the cut can last indefinitely (or until the duty cycle of the Pro-Cut is exceeded). Do not touch the nozzle to the work when cutting. Damage to the consumables may result.

¥ Pierce the workpiece by slowly lowering the torch onto the metal at a 30¡ angle away from the operator. This will blow the dross away from the torch tip. Slowly rotate the torch to vertical position as the arc becomes deeper.



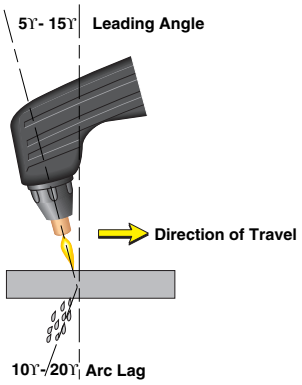
¥ Hold the nozzle standoff 1/8 in. (3.2mm) to 3/16 in. (4.7mm) above the workpiece during cutting. Do not let the torch nozzle touch the work or carry a long arc.

¥ Keep moving while cutting. Cut at a steady speed without pausing. Maintain the cutting speed so that the arc lag is 10¡ to 20¡ behind the travel direction.

¥ Use a 5¡ - 15¡ leading angle in the direction of the cut.

¥ Use the drag cup to maintain constant standoff for better cut quality and to protect the nozzle from spatter.

¥ Use the drag cup with a metal template to prevent nozzle double arcing.



¥ Finish the cut to be made and release the trigger.

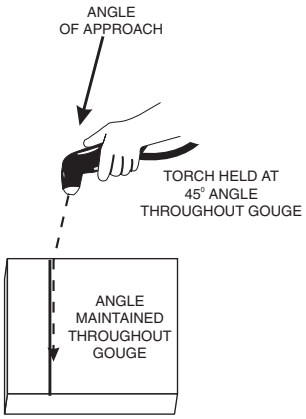
¥ When the trigger is released, the arc will stop.
  - The gas will continue to flow for 10 seconds of postflow. If the trigger is activated within this time period, the pilot arc will immediately restart.

¥ If the dross is difficult to remove, reduce the cutting speed. High speed dross is more difficult to remove than low speed dross.

¥ The right side of the cut is more square than the left as viewed along the direction of travel.

¥ Clean spatter and scale from the nozzle and drag cup frequently.

¥ **For gouging,** tilt the torch about 45¡ from the workpiece and hold the nozzle 1/8 in. (3.2mm) to 3/16Ó (4.7mm) above the workpiece.



SAFETY STATUS INDICATOR

¥ If the "SAFETY" status indicators light at any time, check the following:
  - Check the assembly of the torch consumables. If they are not properly in place, the machine will not start. **Make sure that the shield cup is hand tight. Do not use pliers or overtighten.**

⚠ WARNING

ELECTRIC SHOCK can kill.

¥ Turn off machine at the disconnect switch on the front of the machine before tightening, cleaning or replacing consumables.

- Check the conditions of the inside of the nozzle. If debris has collected, rub the electrode on the inside bottom of the nozzle to remove any oxide layer that may have built up. Refer to ***ÒSuggestions for Extra Utility from the Pro-Cut System.Ó***
- Check the condition of the electrode. If the end has a crater-like appearance, replace it along with the nozzle. The maximum wear depth of the electrode is approximately .062 in. (1.6mm). A green and erratic arc will indicate definite electrode failure. The electrode should be replaced immediately.

¥ Replace the nozzle when the orifice exit is eroded away or oval shaped.

¥ After the problem is found, or if there is nothing apparently wrong, reset the machine by pressing the "Reset" button. (It is possible for electrical noise to trip the safety circuit on rare occasions. This should not be a regular occurrence.)

¥ If the machine does not reset or continues to trip, consult the Troubleshooting Section.

¥ Use the proper cutting or gouging procedures referred to in ÒPɒcedure RecommendationsÓ below.

USER RESPONSIBILITY

Because design, fabrication, erection, and cutting variables affect results, the serviceability of a product or structure is the responsibility of the user. Variation such as plate chemistry, plate surface condition (oil, scale), plate thickness, preheat, quench, gas type, gas flow rate and equipment may produce results different from those expected. Some adjustments to procedures may be necessary to compensate for unique individual conditions. Test all procedures duplicating actual field conditions.

PREHEAT TEMPERATURE FOR PLASMA CUTTING

Preheat temperature control is not necessary in most applications when plasma arc cutting or gouging. Preheat temperature control may be necessary on high carbon alloy steels and heat treated aluminum for crack resistance and hardness control. Job conditions, prevailing codes, alloy level, and other considerations may also require preheat temperature control. The recommended minimum preheat temperature for plate thickness up to 1/2 in. (12.7mm) is 70¡F (21.1¡C). Higher temperatures may be used as required by the job conditions and/or prevailing codes. If cracking or excessive hardness occurs on the cut face, higher preheat temperature may be required.

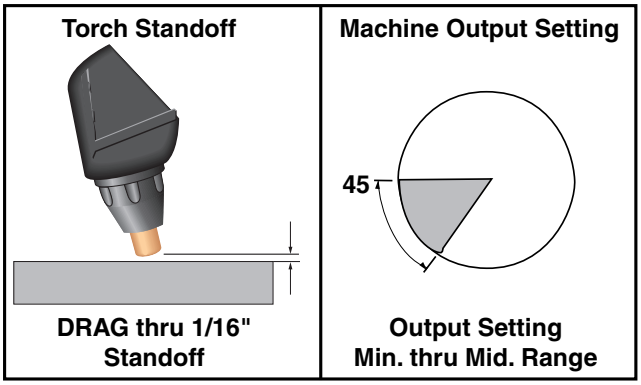
PROCEDURE RECOMMENDATIONS

When properly used, plasma arc cutting or gouging is a very economical process. Improper use will result in a very high operating cost.

GENERAL - IN ALL CASES

¥ Follow safety precautions as printed throughout this manual and on the machine.

THIN GAUGE SHEET METAL

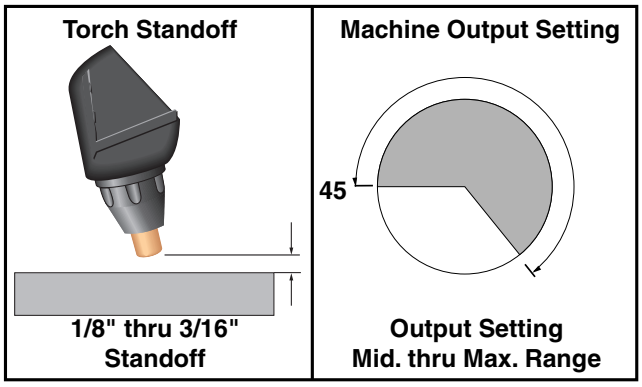


Output set below 45 Amps.

¥ The nozzle may be dragged on the metal surface, touching it lightly to the surface after piercing a hole. Current control should be set below the mid-range.

¥ Do not allow cable or body to contact hot surface.

THICK SECTIONS OF METAL



Output set above 45 Amps.

¥ The best quality and consumable life will be obtained by holding the torch off the surface about 3/16 in. (4.7mm). Too long an arc may compromise cut quality and consumable life. The nozzle should NOT be dragged on the work.

¥ Use of the S22151 Drag Cup will maintain the proper standoff. The only time not to use the drag cup when the output control is set above mid-range is in special, tight corners. Always hold at least a 1/8 in. (3.2mm) standoff in those situations.

¥ If piercing is required, slowly lower the torch at an angle of about 30¡ to blow the dross away from the torch tip and slowly rotate the torch to a vertical position as the arc becomes deeper. This process will blow a lot of molten metal and dross. Be careful! Blow the dross away from the torch, the operator and any flammable objects.

¥ Where possible, start the cut from the edge of the workpiece.

¥ Keep moving! A steady speed is necessary. Do not pause.

¥ Do not allow the torch cable or body to contact a hot surface.

SUGGESTIONS FOR EXTRA UTILITY FROM THE PRO-CUT SYSTEM

⚠ WARNING

ELECTRIC SHOCK can kill.

¥ Turn off machine at the disconnect switch on the front of the machine before tightening, cleaning or replacing consumables.

1. Occasionally an oxide layer may form over the tip of the electrode, creating an insulating barrier between the electrode and nozzle. This will result in the tripping of the Pro-Cut's safety circuit. When this happens, turn the power off, remove the nozzle and electrode and use the electrode to rub against the inside bottom surface of the nozzle. This will help remove any oxide buildup. Replace the nozzle, turn on the power and continue cutting. If the Parts-in-Place circuit (safety status indicator light) continues to trip after cleaning the consumables, replace them with a new set. Do not continue to cut with excessively worn consumables as this can cause damage to the torch head and will degrade cut quality.
2. To improve consumable life, here are some suggestions that may be useful:
   a. Never drag the nozzle on the work surface if the output control knob is above 45 Amps.
   b. Make sure the air supply to the Pro-Cut is clean and free of oil. Use several extra in-line filters if necessary.
   c. Use the lowest output setting possible to make a good quality cut at the desired cut speed.
   d. Minimize dross buildup on the nozzle tip by starting the cut from the edge of the plate when possible.
   e. Pierce cutting should be done only when necessary. If piercing, angle the torch about 30¡ from the plane perpendicular to the workpiece, transfer the arc, then bring the torch perpendicular to the work and begin parallel movement.
   f. Reduce the number of pilot arc starts without transferring to the work.
   g. Reduce the pilot arc time before transferring to the work.
   h. Set air pressure to recommended setting. A higher or lower pressure will cause turbulence in the plasma arc, eroding the orifice of the nozzle tip.
   i. Use only Lincoln consumable parts. These parts are patented. Using any other replacement consumables may cause damage to the torch or reduce cut quality.

MACHINE INTERFACE

The PRO-CUT 80 comes standard with a machine interface. Interface signals provided include: arc start, arc initiated, and arc voltage. These signals are accessible through the 14 pin MS connector on the case front.

ARC START:

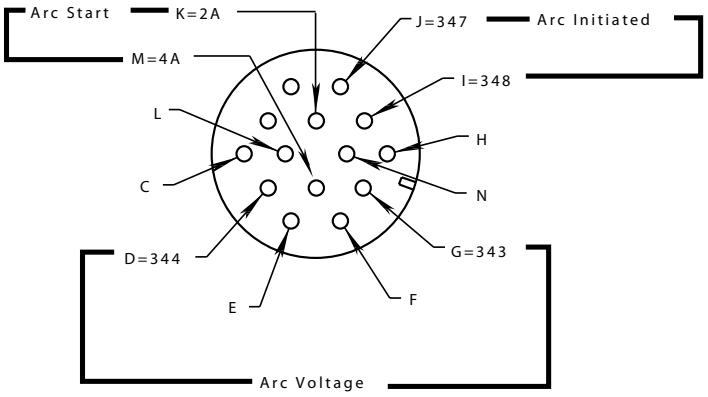
The Arc Start circuit allows for triggering of the power source to commence cutting. This circuit can be accessed through pins K and M of the 14 pin MS connector. The circuit has a 17 VDC nominal open circuit voltage and requires a dry contact closure to activate.

ARC INITIATED:

The Arc Initiated circuit provides information as to when a cutting arc has transferred to the work piece. This circuit can be accessed through pins I and J of the 14 pin MS connector. The circuit provides a dry contact closure when the arc has transferred. Input to this circuit should be limited to 0.3 A for either 120VAC or 30VDC.

ARC VOLTAGE:

The Arc Voltage circuit can be used for activating a torch height control. This circuit can be accessed through pins D and G of the 14 pin MS connector. The circuit provides full electrode to work arc voltage (no voltage divider, 335VDC maximum).



14-PIN BOX RECEPTACLE, FRONT VIEW

Users wishing to utilize the Machine Interface can order a K867 Universal Adapter (please adhere to the pin locations stated above) or manufacture a 14 pin MS connector cable assembly.

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ACCESSORIES

GENERAL OPTIONS / ACCESSORIES

The following options/accessories are available for your PRO-CUT 80 from your local Lincoln Distributor.

K1681-1 Undercarriage - A valet style undercarriage with pull-out handle for machine only. Provides torch and work cable storage.

S22147-043 - Vortechª nozzle with an .043Ó (1.2 mm) Orifice (For 35 - 60 Amps)

S22147-053 - Vortechª nozzle with an .053Ó (1.3 mm) Orifice (For 60 - 85 Amps)

S22147-082 - Vortech™ nozzle with an .082Ó (2.1 mm) Orifice (For Gouging at 60 -85 Amps)

S22149 - Electrode - replacement electrodes for cutting.

S22150 - Shield Cup - This shields the torch tip and provides more visibility to the workpiece than the drag cup. Note the shield cup does not prevent the torch tip from touching the workpiece.

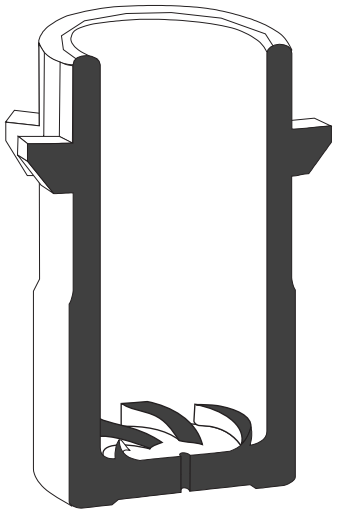
S22151 - Drag Cup - The drag cup protects the torch by preventing the torch from touching the workpiece.

K1571 Series - PCT 80 Torches come in 25Õ and 50Õ lengths in either hand held or mechanized versions.

ALWAYS USE GENUINE LINCOLN ELECTRIC ELECTRODES AND VORTECHª NOZZLES

¥ Only Genuine Lincoln Electric consumables yield the best cutting performance for the PRO-CUT 80.

¥ The patent pending VORTECHª nozzle pr ovides an extra ÒkickÓ of swirl as the ar exits the nozzle, which improves cutting performance. No other nozzle has this capability or can match its performance.



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MAINTENANCE

⚠ WARNING

ELECTRIC SHOCK can kill.

¥ Have an electrician install and service this equipment.

¥ Turn the input power off at the fuse box before working on equipment.

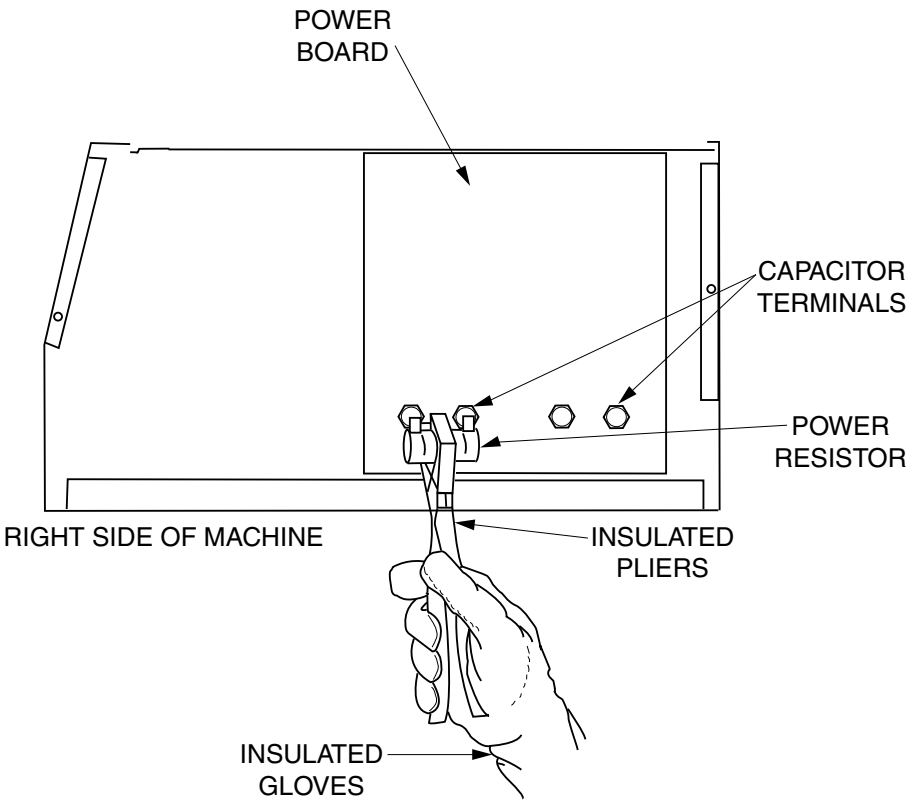
¥ Do not touch electrically hot parts.

¥ Prior to performing preventative maintenance, perform the following capacitor discharge procedure to avoid electric shock.

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

1. Turn off input power or disconnect input power lines.
2. Remove the 5/16 in. hex head screws from the side and top of the machine and remove wrap-around machine cover.
3. Be careful not to make contact with the capacitor terminals that are located on the top and bottom of the Power Board on the right side of the machine.
4. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is not supplied with machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
5. Locate the two capacitor terminals (large hex head cap screws) at the bottom of the Power Board shown in Figure D.1.
6. Use electrically insulated gloves and insulated pliers. Hold the body of the resistor and connect resistor leads across the two capacitor terminals. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.
7. Repeat the discharge procedure for the other capacitor.
8. Check voltage across the terminals of all capacitors with a DC voltmeter. Polarity of capacitor terminals is marked on the Power Board above terminals. Voltage should be zero. If any voltage remains, repeat this capacitor discharge procedure.

FIGURE D.1 Ñ LOCA TION OF INPUT FILTER CAPACITOR TERMINALS



LINCOLN® ELECTRIC

MAINTENANCE

ROUTINE MAINTENANCE

1. Keep the cutting or gouging area and the area around the machine clean and free of combustible materials. No debris should be allowed to collect which could obstruct air flow to the machine.
2. Every 6 months or so, the machine should be cleaned with a low pressure airstream. Keeping the machine clean will result in cooler operation and higher reliability. Be sure to clean these areas. ***SEE FIGURE D.2***
   - Power, Output and Control printed circuit boards and heat sinks
   - Power Switch
   - Main Transformer
   - Input Rectifier
3. Examine the sheet metal case for dents or breakage. Repair the case as required. Keep the case in good condition to insure that high voltage parts are protected and correct spacings are maintained. All external sheet metal screws must be in place to insure case strength and electrical ground continuity.
4. Check the air regulator filter to be sure it does not become clogged. The air filter on the machine is self draining and will not have to be emptied.
5. Check the filter element every several months to see if it is clogged (weekly in very dirty environments). Replace if necessary by first removing the two screws that attach the filter cage to the back panel assembly, then slide the cage away from the back of the machine and remove. Next, twist the clear filter bowl until it comes off (be careful not to lose the o-ring seated at the top of the bowl threads). Unscrew the filter element and replace with new element. Assemble parts in reverse order as described above.
6. Inspect the cable periodically for any slits or puncture marks in the cable jacket. Replace if necessary. Check to make sure that nothing is crushing the cable and blocking the flow of air through the air tube inside. Also, check for kinks in the cable periodically and relieve any so as not to restrict the flow of air to the torch.

PERIODIC MAINTENANCE

⚠ WARNING

ELECTRIC SHOCK can kill.

- Turn off machine at the disconnect switch on the front of the machine before tightening, cleaning or replacing consumables.

Change consumables as required.

1. Thermal Protection

Two thermostats protect the machine from excessive operating temperatures. Excessive temperatures may be caused by a lack of cooling air or by operating the machine beyond the duty cycle and output rating. If excessive operating temperatures should occur, the yellow thermal LED will light and the thermostat will prevent output voltage or current.

Thermostats are self-resetting once the machine cools sufficiently. If the thermostat shutdown was caused by excessive output or duty cycle and the fan is operating normally, the Power Switch may be left on and the reset should occur within a 15 minute period. If the fan is not turning or the air intake louvers were obstructed, then the power must be switched off and the fan problem or air obstruction must be corrected.

2. Filter Capacitor Conditioning (PRO-CUT 80, 400-460 VAC only)

A protection circuit is included to monitor the voltage across filter capacitors C1 and C2. In the event that the capacitor voltage is too high, the protection circuit will prevent output. The protection circuit may prevent output providing all these circumstances are met:

a. Machine is connected for 400-460 or 460-575 VAC input.

b. Machine did not have power applied for many months.

c. Machine will not produce output when power is first switched on.

If these circumstances apply, the proper action is to switch the machine on and let it idle for up to 30 minutes. This is required to condition the filter capacitors after an extended storage time. The protection circuit will automatically reset once the capacitor conditioning and resultant voltage levels are acceptable. It may be necessary to turn the power switch off and back on again after this period.

FIGURE D.2 Ð MAJOR COMPONENT LOCATIONS

1. Case Front
2. Base and Case Back
3. Center Panel Assembly
4. Output Board Heatsink
5. Power Board Assembly
6. Case Wraparound

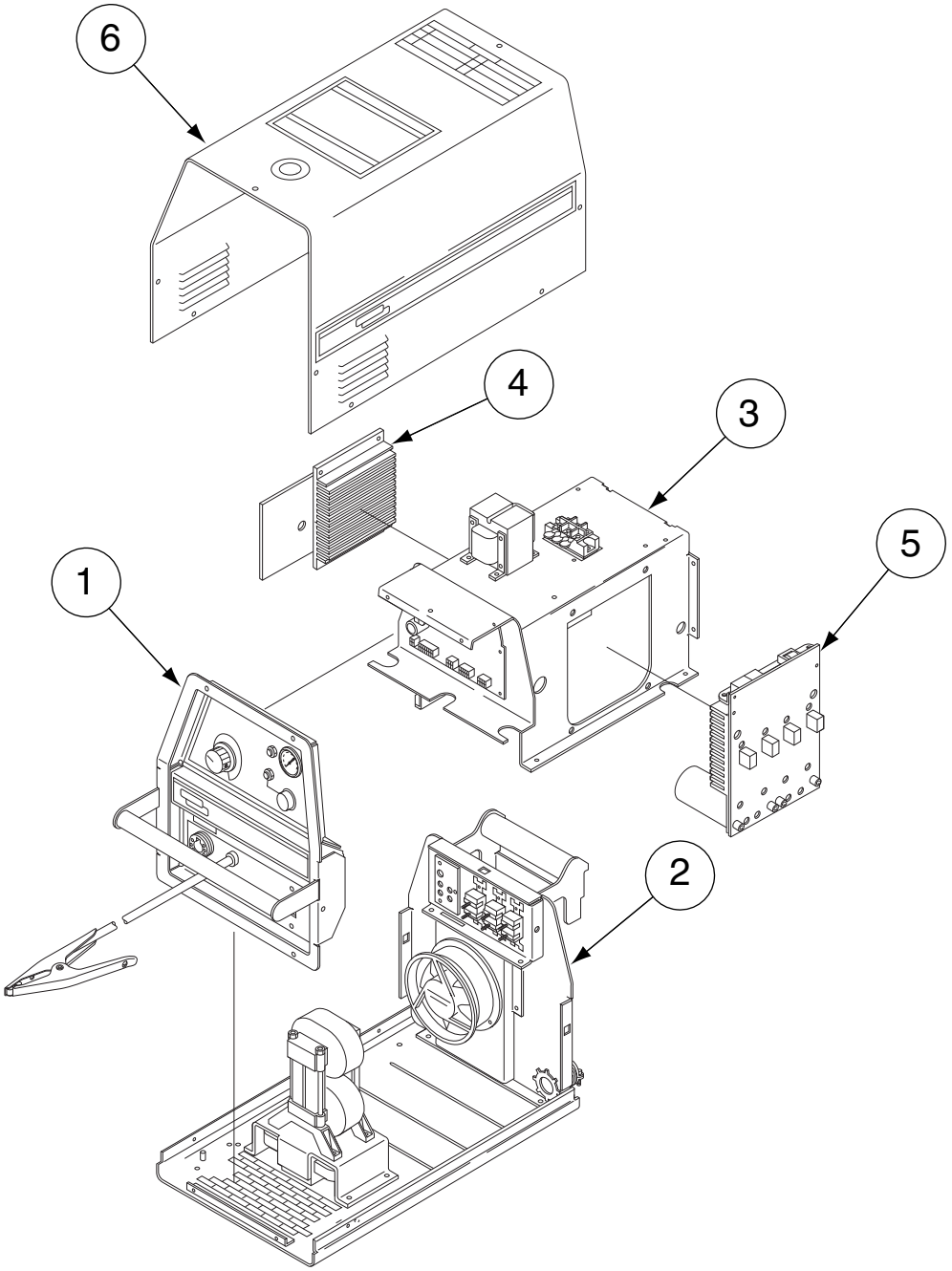


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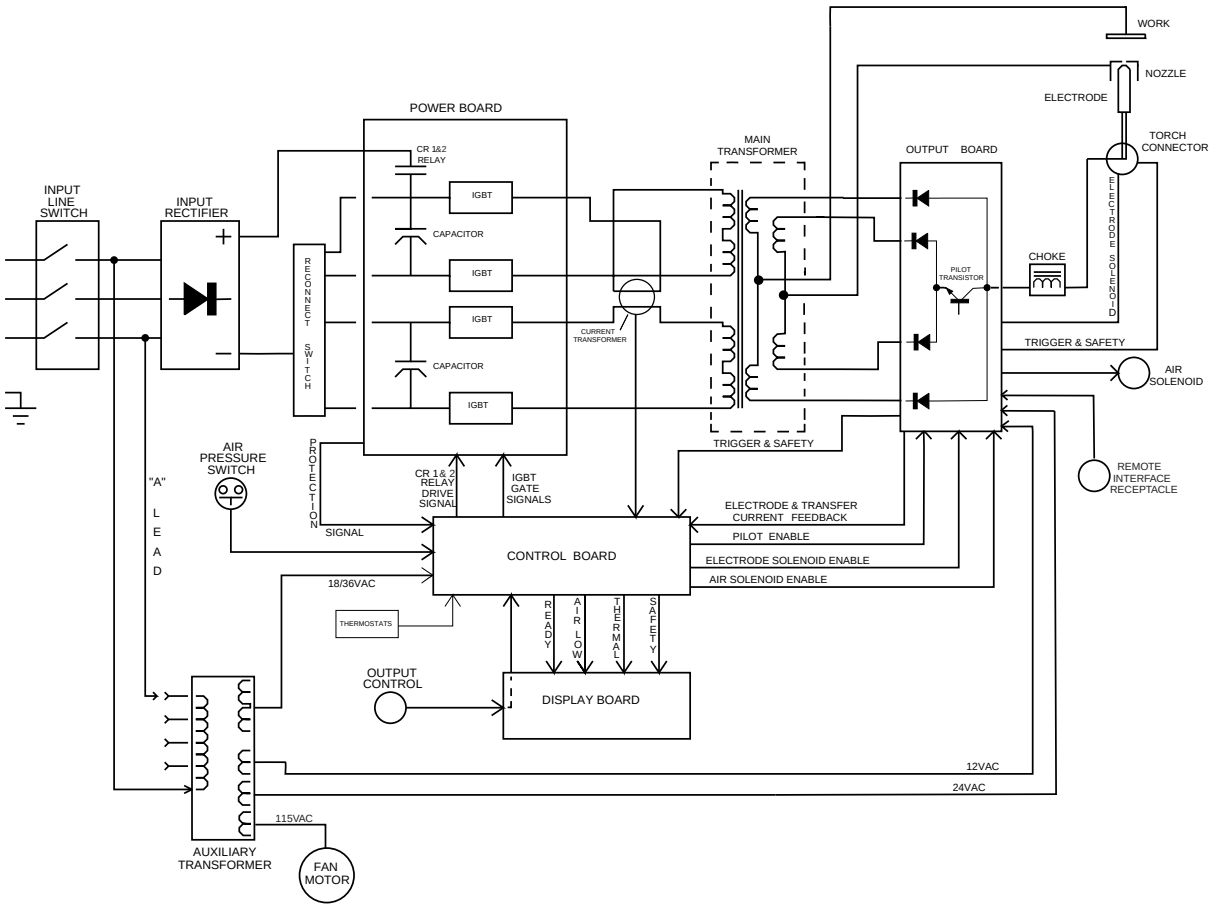
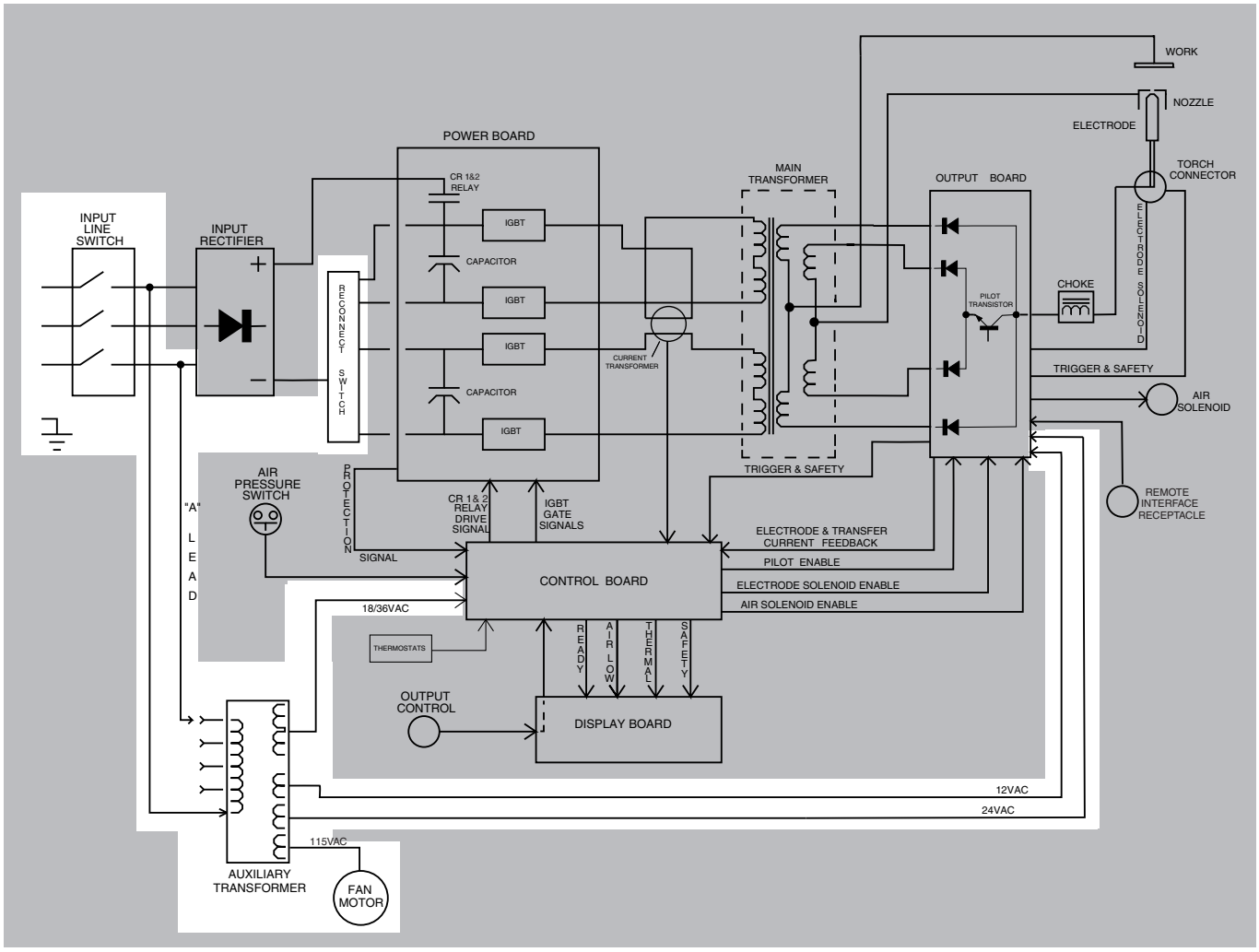
FIGURE E.1 – PRO-CUT 80 BLOCK LOGIC DIAGRAM



THEORY OF OPERATION

FIGURE E.2 Ð INPUT LINE VOLTAGE



GENERAL DESCRIPTION

The PRO-CUT 80 is a constant current, continuous control plasma cutting power source. The inverter based power supply design is controlled by a microprocessor control board. The control system has a safety mechanism to insure that the nozzle and electrode are in place before cutting or gouging. The PRO-CUT 80 initiates the plasma arc with a simple, yet reliable, touch start mechanism. This system eliminates many of the problems associated with hi-frequency type start systems. When powered up, the machine performes some rudimentary self diognostics.

INPUT LINE VOLTAGE, SWITCH AND MAIN TRANSFORMER

The single-phase or three-phase input power is connected to the machine, via an input line cord, to a switch located on the front panel.

A reconnect panel and voltage range switch allow the user to configure the machine for either a low or high input voltage and also connect the auxiliary transformer for the appropriate input voltage.

The auxiliary transformer develops the appropriate AC voltages to operate the cooling fan, the control board and the plasma output board.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

THEORY OF OPERATION

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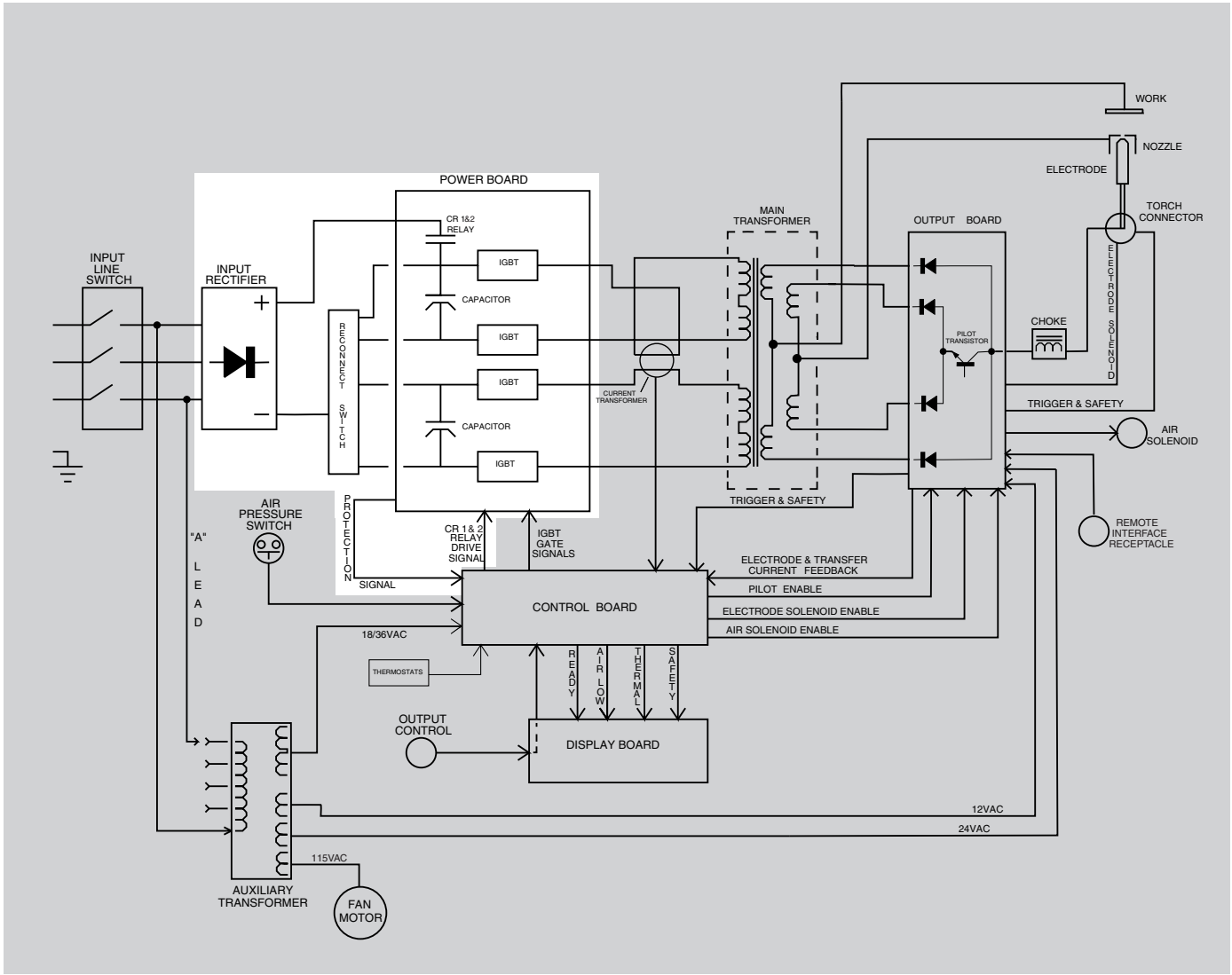


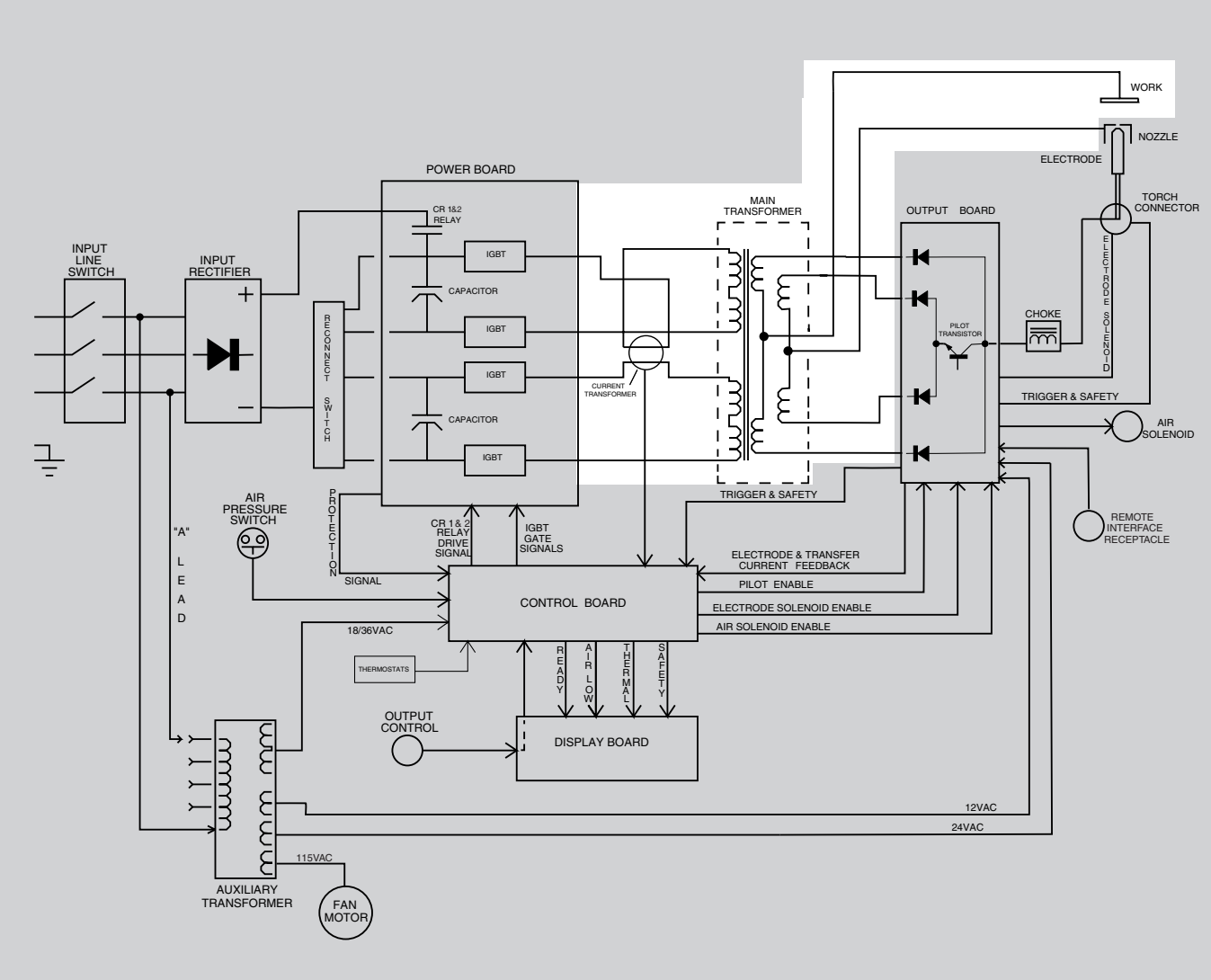
PRECHARGE AND PROTECTION

The input voltage is rectified by the input rectifier. The resultant DC voltage is applied, through the reconnect switch, to the power board. The power board contains precharging circuitry for the safe charging of the input filter capacitors. Once the capacitors are precharged and balanced the control board activates the CR1+ CR2 input relays. This connects full input power to the filter capacitors. When the filter capacitors are fully charged they act as power supplies for the IGBT switching circuit. The Insulated Gate Bipolar Transistors supply the main transformer primary winding with DC current flow. See ***IGBT Operation*** discussion and diagrams in this section.

The power board also monitors the filter capacitors for voltage balance and under or overvoltage. If either should occur, the appropriate signal is sent to the control board to deactivate the CR1+ CR2 input relay. The machine output will also be disabled.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

FIGURE E.4 Ð MAIN TRANSFORMER



MAIN TRANSFORMER

Each IGBT pair acts as a switch assembly. Each assembly feeds a separate, oppositely wound primary winding of the main transformer. The reverse direction of current flow through the main transformer primaries and the offset timing of the IGBT pairs induce an AC square wave output signal at the secondary of the main transformer.

The DC current flow through each primary winding is redirected or "clamped" back to each respective filter capacitor when the IGBTs are turned off. This is needed due to the inductance of the transformer primary winding.

The primary currents also pass through the current transformer, which sends a signal to the control board. If the primary currents are not equal, the control board compensates by adjusting the IGBT gate signals.

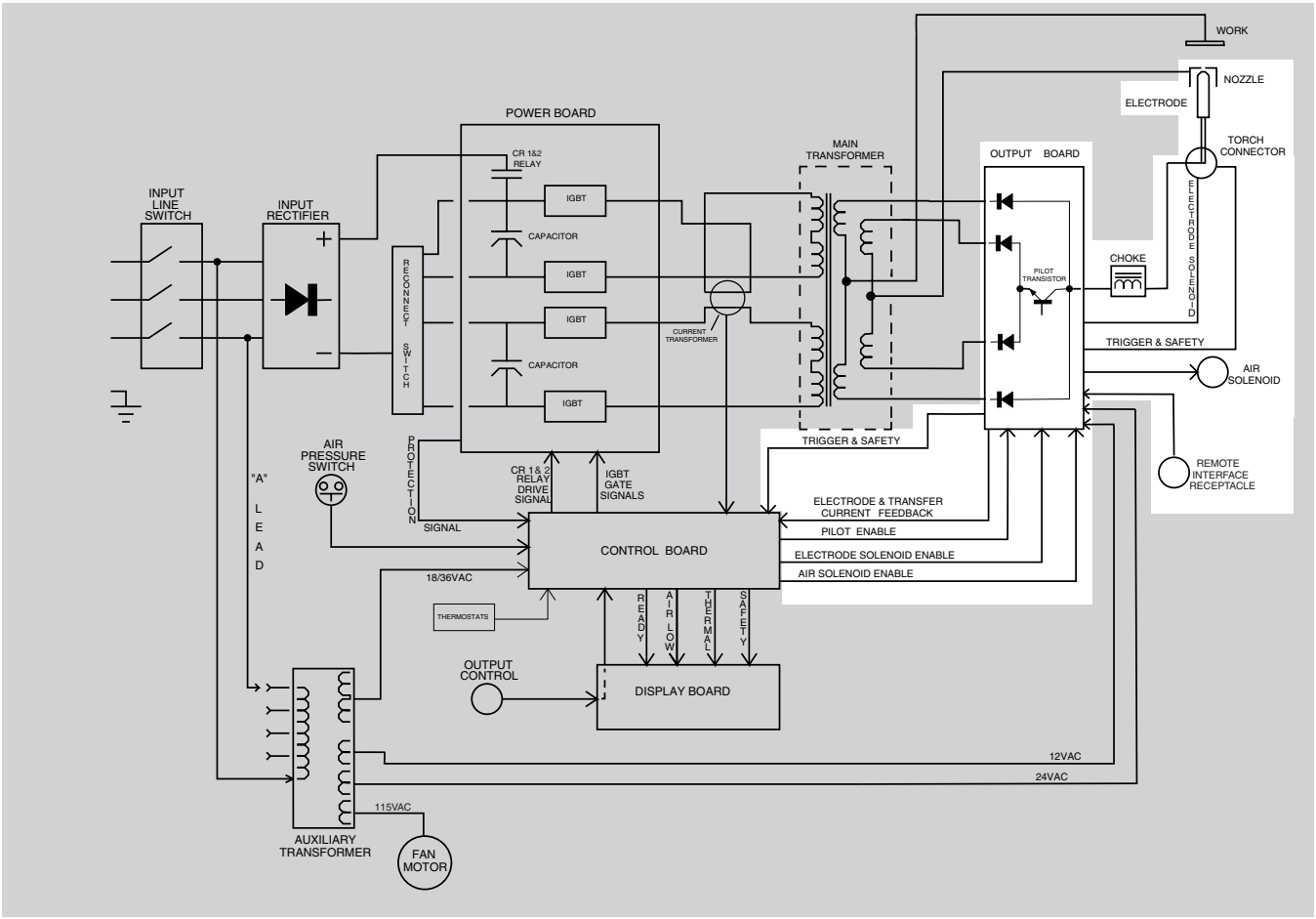
The firing of both IGBT pairs occurs during halves of the 50 microsecond intervals, creating a constant 20KHZ output.

The secondary portion of the main transformer is made up of two separate windings. One secondary winding supplies the electrode-to-work voltage. This is the high current winding, which is capable of supplying maximum output current during the cutting process.

The other secondary winding supplies the electrode-to-nozzle voltage for the pilot arc current. The conductor in this winding is smaller since the pilot current is considerably less than the cutting current. While one winding is conducting the other winding is at a limited voltage and aids in the arc transfer to and from the workpiece.

THEORY OF OPERATION

FIGURE E.5 Ð PLASMA OUTPUT BOARD AND TORCH



OUTPUT BOARD AND TORCH

The output board contains an Insulated Gate Bipolar Transistor (IGBT) which, upon receiving a pilot signal from the control board, either enables or disables the current in the pilot winding. The cutting and pilot rectifier diodes are also incorporated in the output board. There are two diodes for the pilot winding and four diodes for the cutting winding.

There are two P.C. board mounted current sensors. One sensor regulates pilot and cutting current. The other sensor indicates to the control board when and how much current transfers to the workpiece.

The output board also includes the trigger circuitry, the gas solenoid driver, the electrode solenoid driver and the torch parts-in-place circuitry and remote interface circutry.

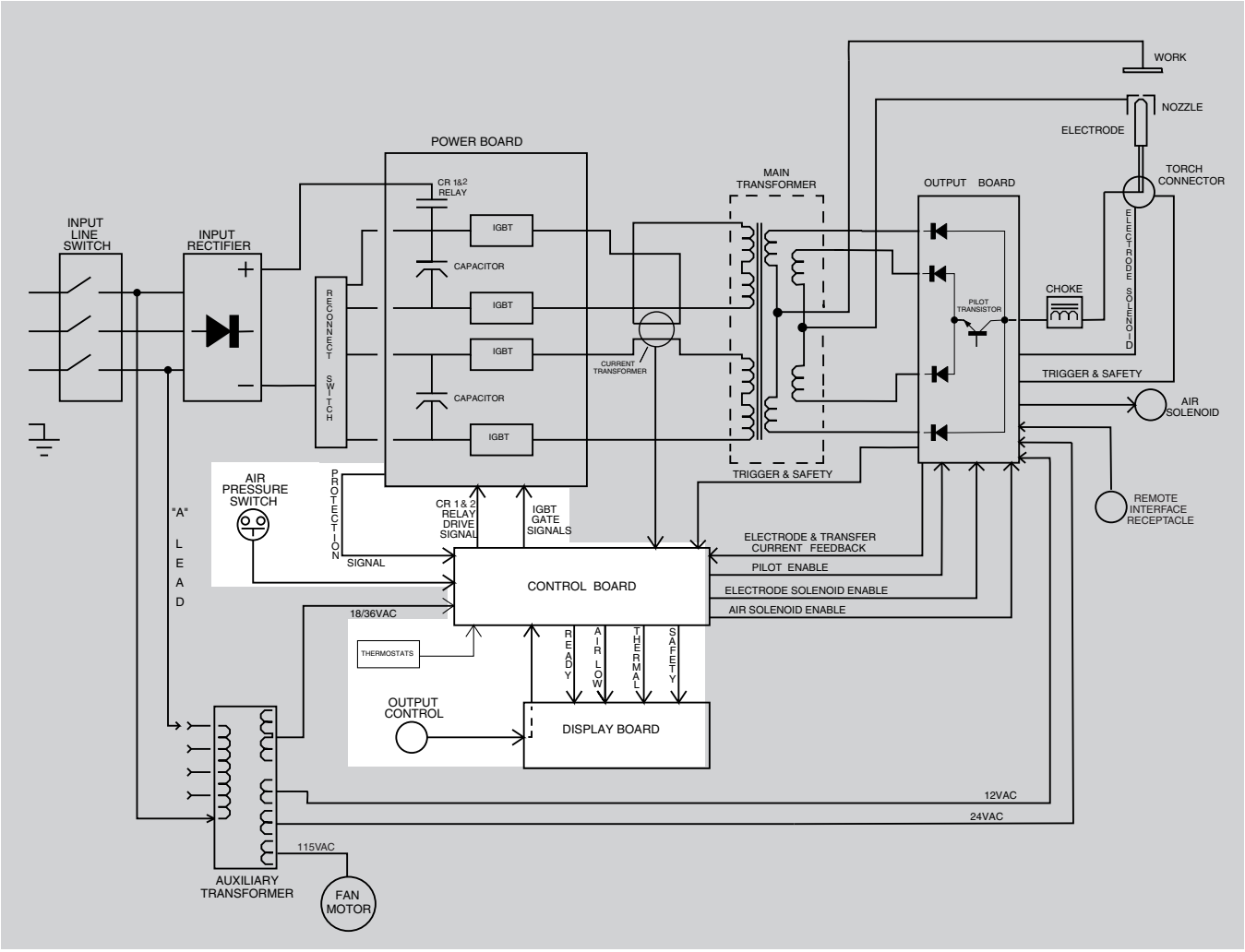
The output choke, which is in series with both the pilot circuit and the cutting circuit, provides current filtering to enhance arc stability.

The PCT 80 torch uses a patented touch start mechanism that provides superior starting performance over other touch start systems. The torch head consists of 3 major parts: torch body, insulator and piston. The insulator provides an electrical barrier between the piston and torch body. The piston provides a path for electrical current to the electrode. The piston also drives the electrode to the nozzle for arc initiation. The torch body contains the main torch components: the trigger, pilot arc, cutting arc, and air flow systems are included.

A copper nozzle with a patented internal swirl is used to focus the arc. A small, precise hole in the end of the nozzle constricts the arc and increases the current density. As the air enters the torch head, it is directed between the electrode and nozzle for maximum electrode cooling. A portion of the cooling air exits the chamber through vents in the side of the nozzle. A swirl texture located inside the bottom of the nozzle increases the plenum air swirl strength, and improves arc start reliability and parts-in-place verification.

Plasma arc initiation occurs as follows: First, in the idle state, a spring inside the torch head pushes the piston and electrode forward to make continuity with the nozzle. When the trigger is pulled, air flow begins and creates enough back force on the electrode to overcome the force of the spring. However, the solenoid valve allows enough forward force on the piston to maintain continuity between the consumables. After this continuity has been verified by the Pro-Cut® parts-in-place circuit, output current is established and regulated. Once the current stabilizes, the solenoid valve turns off, removing the forward force on the piston. The back pressure drives the piston and electrode away from the nozzle, creating the plasma arc. The air stream forces the arc out the orifice of the nozzle. This appears as a pilot arc, which can then be transferred for cutting.

FIGURE E.6 Ð CONTROL AND DISPLAY BOARDS



CONTROL AND DISPLAY BOARDS

The control board receives status and analog feedback signals from the output board, display board, power board and various sensors. The processor interprets these signals, makes decisions and changes machine mode and output to satisfy the requirements as defined by the internal software. The control board regulates the output of the machine by controlling the IGBT switching times through pulse width modulation circuitry. See ***Pulse Width Modulation*** in this section.

The display board receives commands from the control board and, via indicator lights, communicates PRO-CUT 80 status and operating conditions to the user.

PROTECTION CIRCUITS

Protection circuits are designed into the PRO-CUT 80 machine to sense trouble and shut down the machine before the trouble damages internal machine components. Both overload and thermal protection circuits are included.

OVERLOAD PROTECTION

The PRO-CUT 80 is electrically protected from producing higher than normal output currents. If the output current exceeds 85-90 amps, an electronic protection circuit limits the current to within the capabilities of the machine.

Another protection circuit monitors the voltage across the input filter capacitors. If the filter capacitor voltage is too high, too low or not balanced the protection circuit may prevent machine output.

THERMAL PROTECTION

Two thermostats protect the machine from excessive operating temperatures. One thermostat is located on the output choke and the other on the power board IGBT heat sink. Excessive temperatures may be caused by a lack of cooling air or by operating the machine beyond the duty cycle and output rating. If excessive operating temperatures should occur, the thermal status indicator will light and the thermostat will prevent output voltage or current.

Thermostats are self-resetting once the machine cools sufficiently. If the thermostat shutdown was caused by excessive output or duty cycle and the fan is operating normally, the power switch may be left on and the reset should occur within a 15 minute period. If the fan is not turning or the air intake louvers are obstructed, the input power must be removed and the fan problem or air obstruction must be corrected.

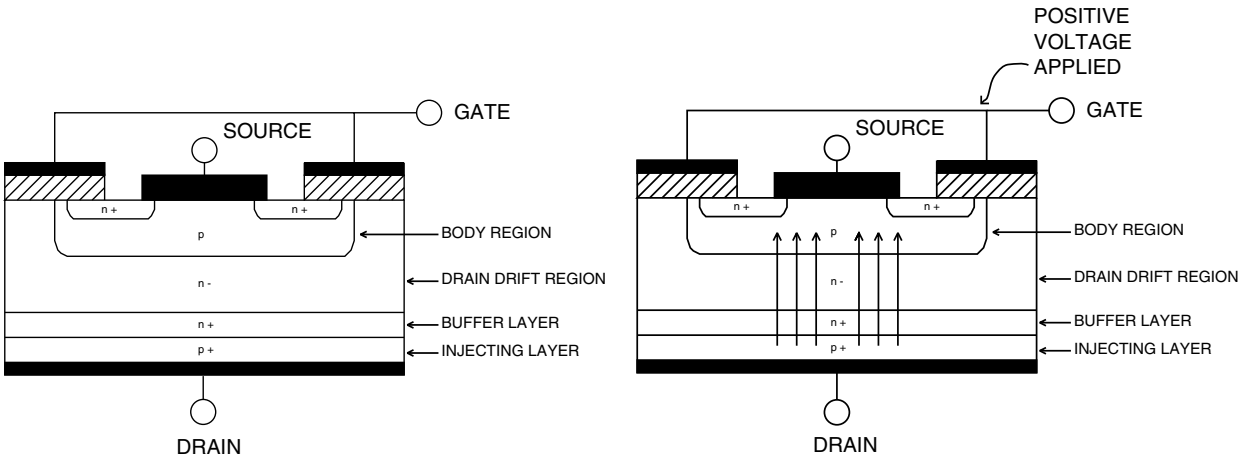
INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBTs are semiconductors well suited for high frequency switching and high current applications.

Drawing A shows an IGBT in a passive mode. There is no gate signal, zero volts relative to the source, and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch in the OFF position.

Drawing B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the source, is applied to the gate terminal of the IGBT, it is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to turning ON a light switch.

FIGURE E.7 Ð CONTROL AND DISPLAY BOARDS



PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION describes how much time is devoted to conduction in the positive and negative portions of the cycle. Changing the pulse width is known as MODULATION. Pulse Width Modulation (PWM) is the varying of the pulse width over the allowed range of a cycle to affect the output of the machine.

MINIMUM OUTPUT

By controlling the duration of the gate signal, the IGBT is turned on and off for different durations during a cycle. The top drawing below shows the minimum output signal possible over a 50-microsecond time period.

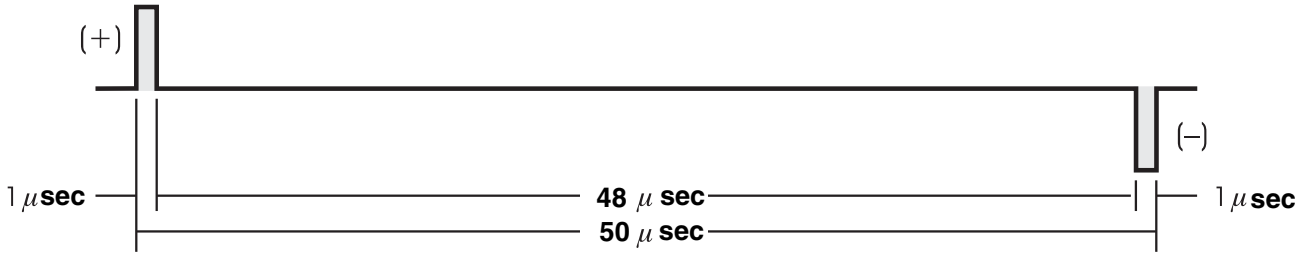
The positive portion of the signal represents one IGBT group[1] conducting for 1 microsecond. The negative portion is the other IGBT group[1]. The dwell time (off time) is 48 microseconds (both IGBT groups off). Since only 2 microseconds of the 50-microsecond time period is devoted to conducting, the output power is minimized.

MAXIMUM OUTPUT

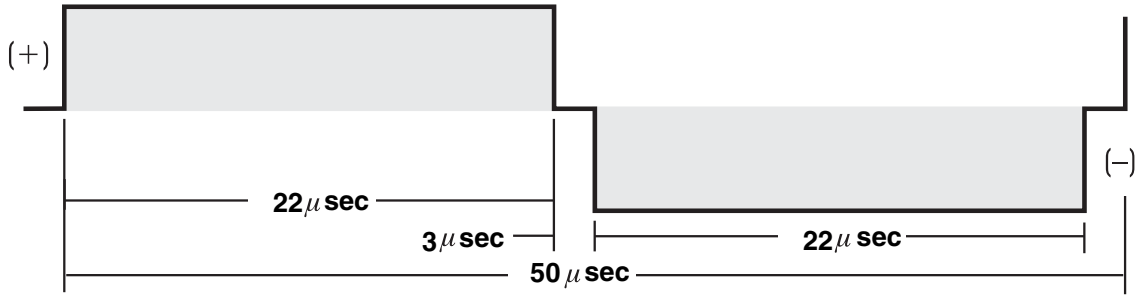
By holding the gate signals on for 22 microseconds each and allowing only 3 microseconds of dwell time (off time) during the 50-microsecond cycle, the output is maximized. The darkened area under the top curve can be compared to the area under the bottom curve. The more dark area under the curve, the more power is present.

[1] An IGBT group consists of two IGBT modules feeding one transformer primary winding.

FIGURE E.8 Ð TYPICAL IGBT OUTPUTS



MINIMUM OUTPUT



MAXIMUM OUTPUT

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HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM). Look under the column labeled "PROBLEM (SYMPTOMS). This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into four main categories: Output Problems, Function Problems, Cutting Problems and LED Function Problems.

Step 2. PERFORM EXTERNAL TESTS. The second column, labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)", lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. PERFORM COMPONENT TESTS. The last column, labeled "Recommended Course of Action" lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the referred to test points, components, terminal strips, etc., can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

TROUBLESHOOTING & REPAIR

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

Have an electrician install and service this equipment. Turn the machine OFF before working on equipment. Do not touch electrically hot parts.

Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

ATTENTION
Static-Sensitive Devices
Handle only at Static-Safe Workstations

Reusable Container
Do Not Destroy

PC Board can be damaged by static electricity.

- Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.
- If you don't have a wrist strap, touch an unpainted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.
- Tools which come in contact with the PC Board must be either conductive, anti-static or static-dissipative.
- Remove the PC Board from the static-shielding bag and place it directly into the equipment. Don't set the PC Board on or near paper, plastic or cloth which could have a static charge. If the PC Board can't be installed immediately, put it back in the static-shielding bag.
- If the PC Board uses protective shorting jumpers, don't remove them until installation is complete.
- If you return a PC Board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

NOTE: Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.
   b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

NOTE: Following this procedure and writing on the warranty report, "INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM," will help avoid denial of legitimate PC board warranty claims.

TROUBLESHOOTING & REPAIR

Observe Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical or electrical damage is evident when the sheet metal cover(s) are removed.	1. Contact your local authorized Lincoln Electric Field Service Facility for technical assistance.	1. Contact the Lincoln Electric Service Department, 1-800-833-9353 (WELD).
Machine is dead – no output – no fan – no status indicator lights.	1. Make sure that the input power switch is in the "ON" position. 2. Check the input voltage at the machine. Input voltage must match the rating plate and the reconnect panel. 3. Check for blown or missing fuses in the input lines and the 0.6 amp slow blow reconnect fuse.	1. Check the input power switch (S1) for proper operation. See the Wiring Diagram. 2. Check the leads associated with the power switch (S1) and the auxiliary transformer (T2) for loose or faulty connections. See the Wiring Diagram. 3. Perform the ***Auxiliary Transformer Test.***
Machine is dead - not output - no status indicator lights - fans run.	1. Check the input voltage at the machine. Input voltage must match the rating plate and the reconnect panel.	1. Perform the ***Auxiliary Transformer Test.*** 2. Perform the ***Low Voltage Circuit Test.*** 3. Perform the ***Input Rectifier Test.*** 4. The control board may be faulty. Replace. 5. The display board may be faulty. Replace.
All status indicators remain lit immediately after power up.	1. The microprocessor has experienced a memory fault. Contact your Local Lincoln Authorized Field Service Facility.	1. The control board may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

TROUBLESHOOTING & REPAIR

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
All the status lights begin to blink within 5 seconds of power up.	1. Make sure the PRO-CUT 80 is reconnected correctly for the input voltage being applied. **Be sure to remove input power and wait at least one minute before changing the position of the input voltage range switch.**	1. Perform the ***Primary Power Board Resistance Test and Capacitor Voltage Test.*** 2. Perform the ***Input Rectifier Test.*** 3. The control board may be faulty. Replace. 4. The primary power board may be faulty. Replace.
The machine powers up properly, but there is no response when the gun trigger is pulled. Only the power LED is lit.	1. Make sure the torch is connected properly to the PRO-CUT 80 machine. 2. Make sure the air supply is connected and operating properly. 3. Make sure the torch head consumable parts are in place and in good condition. Replace if necessary.	1. Perform the ***Auxiliary Transformer Test.*** 2. Perform the ***Trigger Circuit Test.*** 3. Perform the ***Gas Solenoid Test.*** 4. Perform the ***Torch Continuity and Solenoid Test.*** 5. The control board may be faulty. Replace. 6. The output power board may be faulty. Perform the ***Output Board Resistance Test.***
When the torch trigger is pulled, air begins to flow; but no pilot arc is established.	1. Make sure the torch consumables are in place and in good condition. Replace if necessary. 2. Make sure the air pressure is set at 70 psi (448 kPa.) 3. Make sure there are no kinks or restrictions for air flow in the torch cable.	1. Perform the ***Torch Continuity and Solenoid Test.*** 2. Perform the ***Low Voltage Circuit Test.*** 3. The output board may be faulty. Perform the ***Output Board Resistance Test.*** 4. The control board may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

TROUBLESHOOTING & REPAIR

Observe Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The air begins to flow when the torch trigger is pulled. There is a very brief pilot arc. (Normal is 3 seconds.) The sequence is repeated with subsequent trigger pulls.	1. Make sure the air pressure is set at 70 psi (448 kPa.) 2. Make sure the torch consumables are in place and in good condition. 3. Make sure the air flow is not restricted.	1. Perform the ***Torch Continuity and Solenoid Test.*** 2. The output board may be faulty. Replace. 3. The control board may be faulty. Replace.
The cutting arc starts but sputters badly.	1. Make sure the operating procedure is correct for the process. See the ***Operation*** section of this manual. 2. Make sure the work clamp is connected tightly to the workpiece. 3. Make sure the torch consumables are in place and in good condition. 4. Make sure the air supply is not contaminated with oil or excessive water. 5. Make sure the air pressure is set at 70 psi (448 kPa.)	1. Perform the ***Torch Continuity and Solenoid Test.*** 2. The output board may be faulty. Replace. 3. The control board may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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TROUBLESHOOTING & REPAIR

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
CUTTING PROBLEMS		
The pilot arc is normal, but the arc will not transfer to the workpiece.	1. Make sure the operating procedure is correct for the process. See the ***Operation*** section of this manual. 2. Make sure the work clamp is connected tightly to the workpiece. 3. The workpiece must be electrically conductive material.	1. Check the lead connections X2, X4 and B21 at the output board. 2. Check the output control potentiometer (R1). Normal resistance is 10 ohms. Also check the associated leads for loose or faulty connections to the display board. See the Wiring Diagram. 3. Check leads #216, #218 and #219 between the display board and the control board. Check for loose or faulty connections. See the Wiring Diagram. 4. The control board may be faulty. Replace. 5. The output board may be faulty. Perform the ***Output Board Resistance Test.*** 6. The display board may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

TROUBLESHOOTING & REPAIR

Observe Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
LED FUNCTION PROBLEMS		
The Air Low LED is lit.	1. Make sure there is at least 70 psi (448 kPa) of air pressure connected to the gas connection at the back of the PRO-CUT 80. 2. Press the purge button and set the regulator to 70 psi (448 kPa). Do not reset the air pressure while the air is off (not flowing).	1. The pressure switch (S5) or associated leads may be faulty. See the Wiring Diagram. 2. The control board may be faulty. Replace.
The Safety LED is flashing.	1. Make sure there is a Lincoln PCT 80 torch connected properly to the PRO-CUT 80. 2. Make sure the torch consumables are in place and in good condition.	1. Perform the ***Torch Continuity and Solenoid Test.*** 2. Check leads “N”, “E”, #364, and #369 between the torch receptacle, the output board, and the Transformer. (See the Wiring Diagram) 3. The output board may be faulty. Replace.
The Safety LED is lit and steady.	1. Press the reset button. If the torch and consumables are properly installed, the Safety LED should turn off.	1. The reset button or associated wiring may be faulty. See the Wiring Diagram. 2. Perform the ***Torch Continuity and Solenoid Test.*** 3. The control board may be faulty. Replace. 4. If the machine operates normally with the Safety LED on, the display board may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

TROUBLESHOOTING & REPAIR

Observe Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
LED FUNCTION PROBLEMS		
The Thermal LED is lit.	1. One of the machine's thermostats has tripped. Do not turn the PRO-CUT 80 off. Allow the machine to cool. The thermostat(s) will reset themselves. Either the duty cycle has been exceeded, the fan is not functioning or the louvers are blocked.	1. A thermostat may be faulty. Replace. 2. The control board may be faulty. Replace. 3. If the machine operates normally with the Thermal LED lit, the display board may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

This procedure will drain off any charge stored in the two large capacitors that are part of the power board assembly. This procedure MUST be performed, as a safety precaution, before conducting any test or repair procedure that requires you to touch internal components of the machine.

MATERIALS NEEDED

Volt/Ohmmeter (Multimeter)
5/16” Nut driver
Insulated gloves
Insulated pliers
High wattage resistor - 25 to 1000 ohms, 25 watts minimum

This procedure takes approximately 10 minutes to perform.

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE *(continued)*

⚠ WARNING

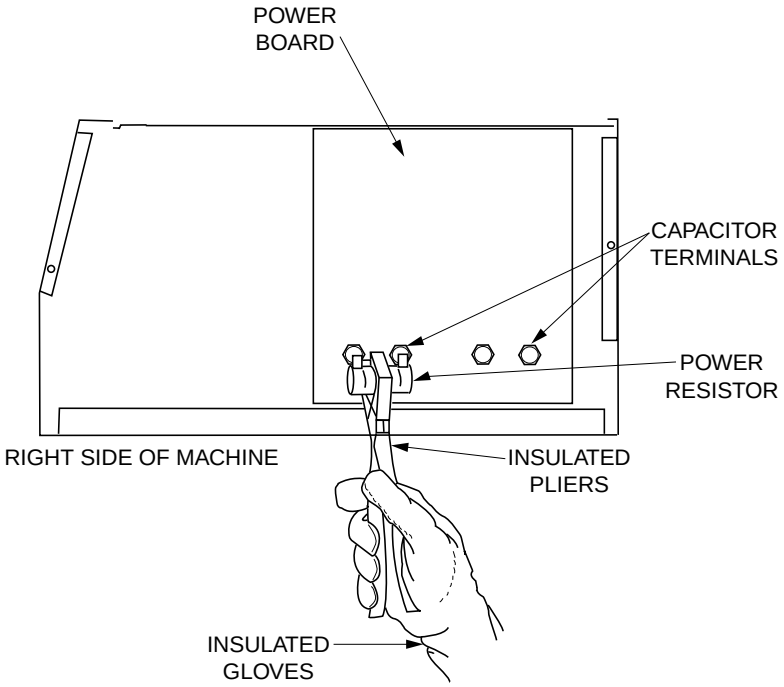
ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment.
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.
- Prior to performing preventative maintenance, perform the following capacitor discharge procedure to avoid electric shock.

DISCHARGE PROCEDURE

1. Turn off input power and disconnect input power lines.
2. Remove the 5/16" hex head screws from the wraparound machine cover.
3. Be careful not to make contact with the capacitor terminals located at the bottom of the Input Power Board.
4. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is not supplied with machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
5. Locate the four capacitor terminals (large hex head cap screws) shown in Figure F.1. At the bottom of the PowerBoard (203,206)(207,202)
6. Use electrically insulated gloves and insulated pliers. Hold the body of the resistor and connect the resistor leads across the two capacitor terminals. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.
7. Repeat the discharge procedure for the capacitor on the other two terminals.
8. Check the voltage across the terminals of all capacitors with a DC voltmeter. Polarity of the capacitor terminals is marked on the PC board above the terminals. Voltage should be zero. If any voltage remains, repeat this capacitor discharge procedure.

FIGURE F.1 – LOCATION OF INPUT FILTER CAPACITOR TERMINALS



INPUT RECTIFIER TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

This test will help determine if the input rectifier has “shorted” or “open” diodes.

MATERIALS NEEDED

Analog voltmeter/ohmmeter (multimeter)
Phillips head screw driver
Wiring diagram

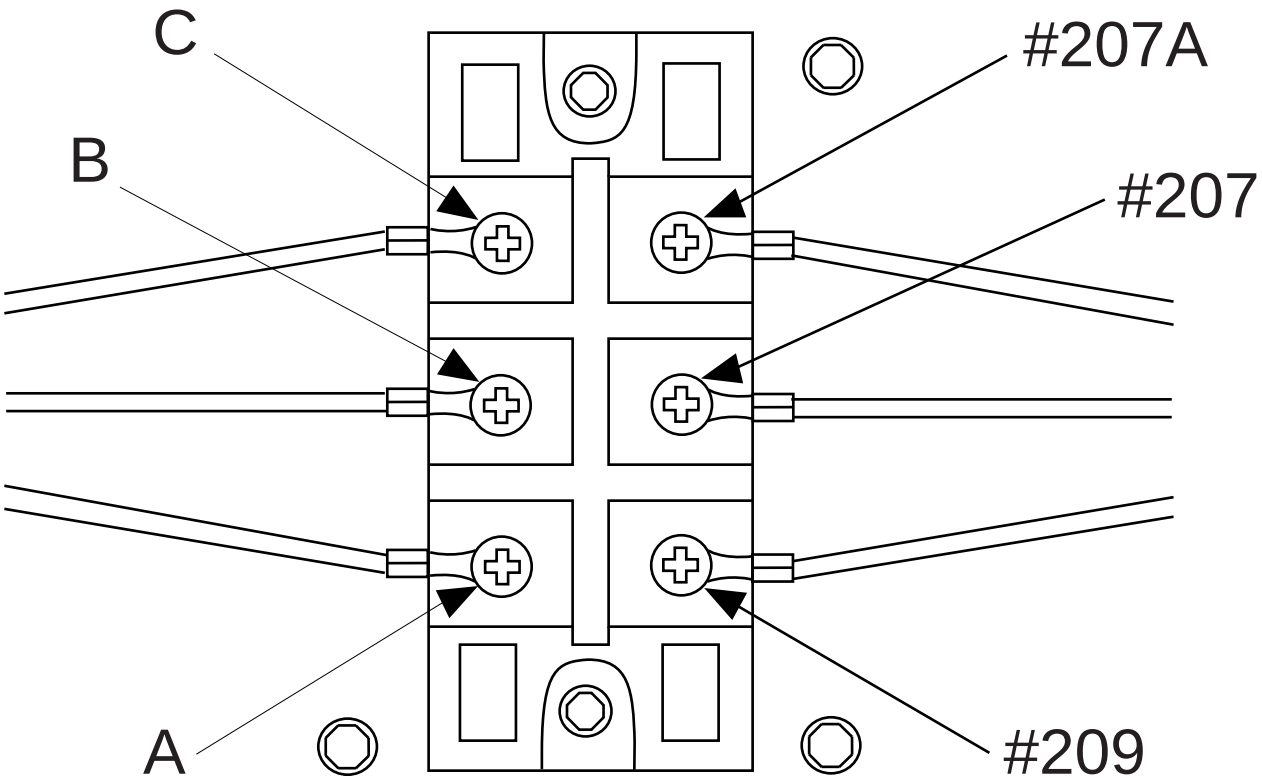
This procedure takes approximately 15 minutes to perform.

INPUT RECTIFIER TEST *(continued)*

TEST PROCEDURE

1. Remove main input power to the machine.
2. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Locate the input rectifier (D1) and lead locations. See Figure F.2. Carefully remove the silicone sealant from leads #207, #207A, and #209.
4. With the phillips head screw driver, remove leads #207, 207A and #209 from the rectifier.
5. Use the analog ohmmeter to perform the tests detailed in ***Table F.1.*** See the Wiring Diagram.

FIGURE F.2 – INPUT RECTIFIER AND LEADS



TOP VIEW

INPUT RECTIFIER TEST *(continued)*

TABLE F.1 INPUT RECTIFIER TEST POINTS

TEST POINT TERMINALS		ANALOG METER X10 RANGE
+Probe	- Probe	Acceptable Meter Readings
A	207	Greater than 1000 ohms
B	207	Greater than 1000 ohms
C	207	Greater than 1000 ohms
A	207A	Greater than 1000 ohms
B	207A	Greater than 1000 ohms
C	207A	Greater than 1000 ohms
A	209	Less than 100 ohms
B	209	Less than 100 ohms
C	209	Less than 100 ohms
207	A	Less than 100 ohms
207	B	Less than 100 ohms
207	C	Less than 100 ohms
207A	A	Less than 100 ohms
207A	B	Less than 100 ohms
207A	C	Less than 100 ohms
209	A	Greater than 1000 ohms
209	B	Greater than 1000 ohms
209	C	Greater than 1000 ohms

6. If the input rectifier does not meet the acceptable readings outlined in Table F.1, the component may be faulty. Replace.

NOTE: Before replacing the input rectifier (D1) check the input power switch (S1) and perform the ***Primary Power Board Resistance Test.*** Also check for leaky or faulty filter capacitors.

7. If the input rectifier is good, be sure to reconnect leads #207, #207A and #209 to the correct terminals and torque to 31 in.-lbs. Apply a coating of Essex D-4-8 insulating compound and Dow Corning 738 Silicone Sealant.
8. If the input rectifier is faulty, see the ***Input Rectifier Bridge Removal & Replacement*** procedure. See the Wiring Diagram and ***Figure F.2.***

TROUBLESHOOTING & REPAIR

PRIMARY POWER BOARD RESISTANCE TEST AND CAPACITOR VOLTAGE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

This test will determine if the primary power board has any “shorted” or “leaky” power diodes or Insulated Gate Bipolar Transistors (IGBTs). Also it will help to indicate any “shorted” input filter capacitors.

MATERIALS NEEDED

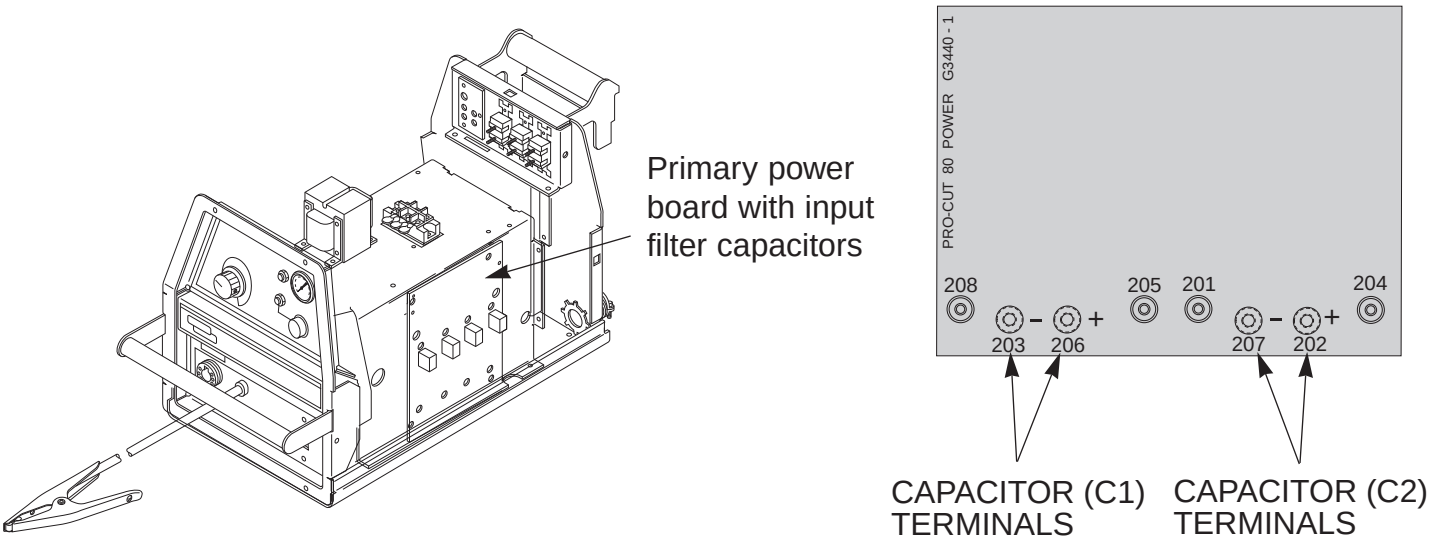
Analog voltmeter/ohmmeter (multimeter)
Wiring Diagram
7/16” Wrench

This procedure takes approximately 25 minutes to perform.

TROUBLESHOOTING & REPAIR

PRIMARY POWER BOARD RESISTANCE TEST AND CAPACITOR VOLTAGE TEST *(continued)*

FIGURE F.3 – PRIMARY POWER BOARD REMOVAL



TEST PROCEDURE

1. Remove main input power to the PRO-CUT 80.
2. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Locate the primary power board and associated lead locations. See Figure F.3.
4. Carefully remove the main transformer primary leads #201, #204, #205 and #208 from the power board.
5. Use the analog ohmmeter to perform the test outlined in ***Table F.2.***

PRIMARY POWER BOARD RESISTANCE TEST AND CAPACITOR VOLTAGE TEST *(continued)*

TABLE F.2
PRIMARY POWER BOARD RESISTANCE TEST POINTS

TEST POINT TERMINALS		ANALOG METER X10 RANGE
+ Probe	**- Probe**	**Acceptable Meter Readings**
201	207A	Greater than 1000 ohms
207A	201	Less than 100 ohms
204	207A	Greater than 1000 ohms
207A	204	Less than 100 ohms
202A	204	Greater than 1000 ohms
204	202A	Less than 100 ohms
202A	201	Greater than 1000 ohms
201	202A	Less than 100 ohms
205	203A	Greater than 1000 ohms
203A	205	Less than 100 ohms
208	203A	Greater than 1000 ohms
203A	208	Less than 100 ohms
206	208	Greater than 1000 ohms
208	206	Less than 100 ohms
206	205	Greater than 1000 ohms
205	206	Less than 100 ohms

6. If the power board does not meet the acceptable readings outlined in Table F.2, the board is faulty. Replace. See ***Power Board Removal and Replacement Procedure.***

   NOTE: Complete power board and filter capacitor replacement is recommended.

7. If the power board "passes" the resistance test, the IGBT portion of the board is good. However, other circuits on the power board may be faulty. These circuits are NOT readily tested or serviceable.

8. Carefully reconnect leads #201, #204, #205, and #208 to their appropriate terminals. Torque To 75 IN. LBS.

PRIMARY POWER BOARD RESISTANCE TEST AND CAPACITOR VOLTAGE TEST *(continued)*

CAPACITOR VOLTAGE TEST

This test will help the technician to determine if the input filter capacitors are being charged equally to the correct voltage levels.

NOTE: This test should only be conducted with the PRO-CUT 80 connected for 400 VAC or above, and with the appropriate input voltage applied.

TEST PROCEDURE

1. Remove main input power to the PRO-CUT 80.
2. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Locate and familiarize yourself with the capacitor test locations on the primary power board. See ***Figure F.3.***
4. The following tests will be performed with the input power applied to the PRO-CUT 80. ***BE CAREFUL. ALWAYS REMOVE THE INPUT POWER AND PERFORM THE INPUT FILTER CAPACITOR DISCHARGE PROCEDURE BEFORE TOUCHING ANY MACHINE COMPONENT.***

⚠ WARNING

ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment.
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.

5. Apply the correct input power† and turn ON the PRO-CUT 80.

† **NOTE:** This test should only be conducted with the PRO-CUT 80 reconnect switch and "A" jumper configured for 400 VAC and above.

PRIMARY POWER BOARD RESISTANCE TEST AND CAPACITOR VOLTAGE TEST *(continued)*

6. Check for the appropriate voltages outlined in Table F.3.

   NOTE: Voltages may vary with the input line voltage.

   NOTE: If the capacitor voltage is too high (over 400 VDC) or too low (less than 220 VDC) the control board will deactivate relay CR1 + CR2. This will prevent output.

7. If the test voltages do not meet the expected values as listed in Table F.3, the capacitors or other components on the power board may be faulty. Replace.

NOTE: If the capacitor voltages are NOT balanced within 20 VDC, the capacitors may need "conditioning." See the ***Maintenance*** section.

TABLE F.3 - CAPACITOR VOLTAGES

INPUT APPLIED	EXPECTED VOLTS DC AT CAPACITOR TERMINALS
460VAC	325VDC
440VAC	311VDC
415VAC	293VDC
380VAC	269VDC

NOTE: If Capacitor C1 is found to be defective, both Capacitors C1 and C2 must be replaced at the same time. The capacitors must be replaced in matched sets.

OUTPUT POWER BOARD RESISTANCE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

This test will help the technician determine if the output power board is faulty.

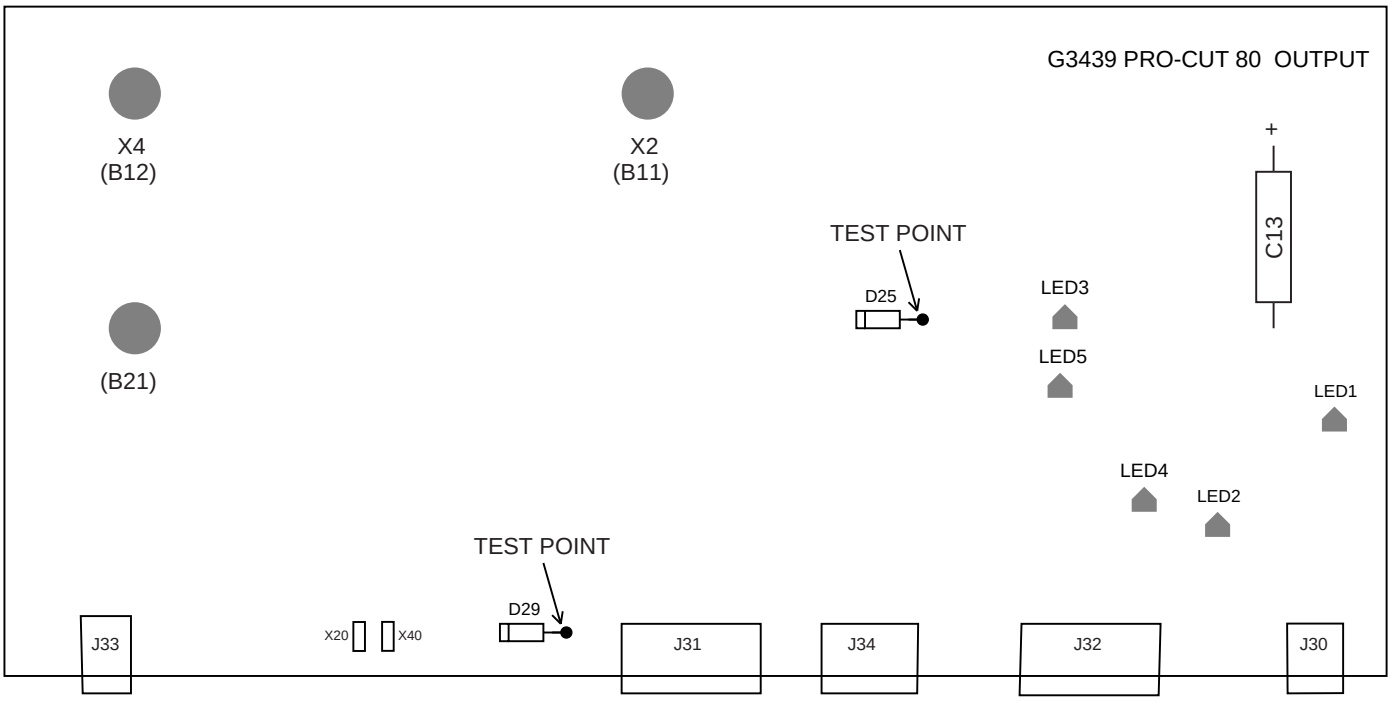
MATERIALS NEEDED

5/16” Nut driver
Analog Volt/ohmmeter
7/16” Wrench

This procedure takes approximately 18 minutes to perform.

OUTPUT POWER BOARD RESISTANCE TEST *(continued)*

FIGURE F.4 – OUTPUT POWER BOARD LEAD LOCATIONS



TEST PROCEDURE

1. Remove input power to the PRO-CUT 80 machine.
2. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Remove the torch assembly from the machine.
4. Carefully remove leads X4, X2, B21, X20, X40 and plugs J33 and J32 from the output power board. See Figure F.4.
5. Using the analog ohmmeter, perform the resistance checks per ***Table F.4.***

OUTPUT POWER BOARD RESISTANCE TEST *(continued)*

TABLE F.4 - OUTPUT POWER BOARD RESISTANCE

TEST POINTS	CIRCUIT OR COMPONENT(S) BEING TESTED	EXPECTED RESISTANCE
+Probe J33-Pin4 to –Probe Terminal X2	Diode A1 and associated trace	Less than 100 ohms
+Probe Terminal X2 to –Probe J33-Pin4	Diode A1 and associated trace	Greater than 1000 ohms
+Probe J33-Pin4 to –Probe Terminal X4	Diode A1 and associated trace	Less than 100 ohms
+Probe Terminal X4 to –Probe J33-Pin4	Diode A1 and associated trace	Greater than 1000 ohms
+Probe D29 Test Point to –Probe Terminal X20	Diode A2 and associated trace	Less than 100 ohms
+Probe Terminal X20 to –Probe D29 Test Point	Diode A2 and associated trace	Greater than 1000 ohms
+Probe D29 Test Point to -Probe Terminal X40	Diode A2 and associated trace	Less than 100 ohms
+Probe Terminal X40 to –Probe D29 Test Point	Diode A2 and associated trace	Greater than 1000 ohms
+Probe D29 Test Point to –Probe J32-Pin14	Transistor A2 and associated trace	Less than 100 ohms
+Probe J32-Pin14 to –Probe D29 Test Point	Transistor A2 and associated trace	Greater than 1000 ohms

6. If any of the resistance checks are not correct, the output power board is faulty. Replace. See the ***Output Power Board Removal and Replacement Procedure.***
7. If the output power board “passes” the resistance test, the power diode and transistor portion of the board is good. However, other circuits on the power board may be faulty. These circuits are NOT readily tested or serviceable.
8. Carefully reconnect the leads and plugs previously removed. Torque X2, X4, and B21 to 75 IN. LBS.

TORCH CONTINUITY AND SOLENOID TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

This procedure will help the technician determine if the torch cable, consumables and electrode solenoid are functioning properly.

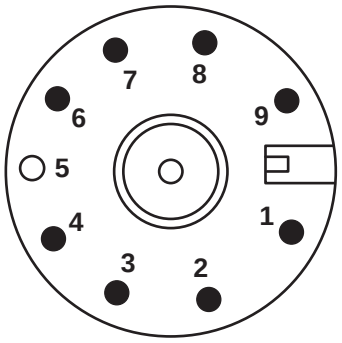
MATERIALS NEEDED

Volt/ohmmeter
12 VDC @ 1 Amp Power Supply

This procedure takes approximately 15 minutes to perform.

TORCH CONTINUITY AND SOLENOID TEST *(continued)*

FIGURE F.5 - TORCH CONNECTOR - MACHINE END



TEST PROCEDURE

1. Remove input power to the PRO-CUT 80 machine.
2. Remove the torch assembly from the machine.
3. Using the ohmmeter, check the torch resistances per Table F.5.

NOTE: Take the "Pin" test point measurements at the machine end of the torch assembly. See Figure F.5.

TABLE F.5 - TORCH ASSEMBLY RESISTANCES

TEST POINTS	CIRCUIT(S) BEING TESTED	EXPECTED RESISTANCE	TEST CONDITIONS
Pin 7 to Pin 8	Parallel pilot arc leads	1.5 ohms maximum	None
Pin 7 to Torch Nozzle	One pilot arc lead to nozzle	1.0 ohm maximum	Torch consumables in place
Pin 8 to Torch Nozzle	One pilot arc lead to nozzle	1.0 ohm maximum	Torch consumables in place
Pin 1 to Pin 9	Torch trigger circuit	100K ohms minimum	Torch trigger NOT pulled (not activated)
Pin 1 to Pin 9	Torch trigger circuit	1.0 ohm maximum	Torch trigger pulled (activated)
Pin 2 to Pin 3	Electrode Solenoid	45 to 55 ohms	None
Pin 7 to Torch Electrode at machine end of torch	Pilot and Electrode circuit	1.0 ohm maximum	Torch consumables in place
Pin 8 to Torch Electrode at machine end of torch	Pilot and Electrode circuit	1.0 ohm maximum	Torch consumables in place

4. If any of the resistance checks are not correct, the torch assembly may be faulty. Repair or replace.
5. Carefully apply the 12 VDC supply to the electrode solenoid. (positive to Pin 2 and negative to Pin 3). The electrode solenoid should activate. Listen for the solenoid action in the torch handle. If the solenoid does not activate, it may be faulty. Replace.

AIR/GAS SOLENOID TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

This procedure will help the technician determine if the solenoid is functioning properly.

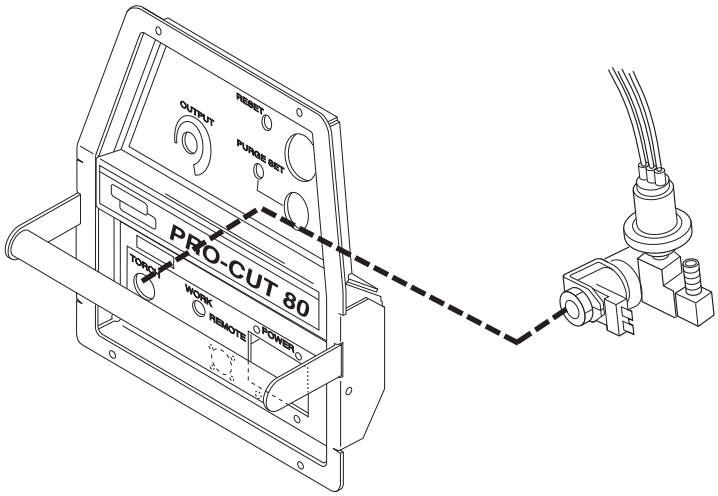
MATERIALS NEEDED

5/16” Nut driver
12 VDC @ 3 amp supply
Volt/ohmmeter

This procedure takes approximately 13 minutes to perform.

AIR/GAS SOLENOID TEST *(continued)*

FIGURE F.6 – AIR SOLENOID



TEST PROCEDURE

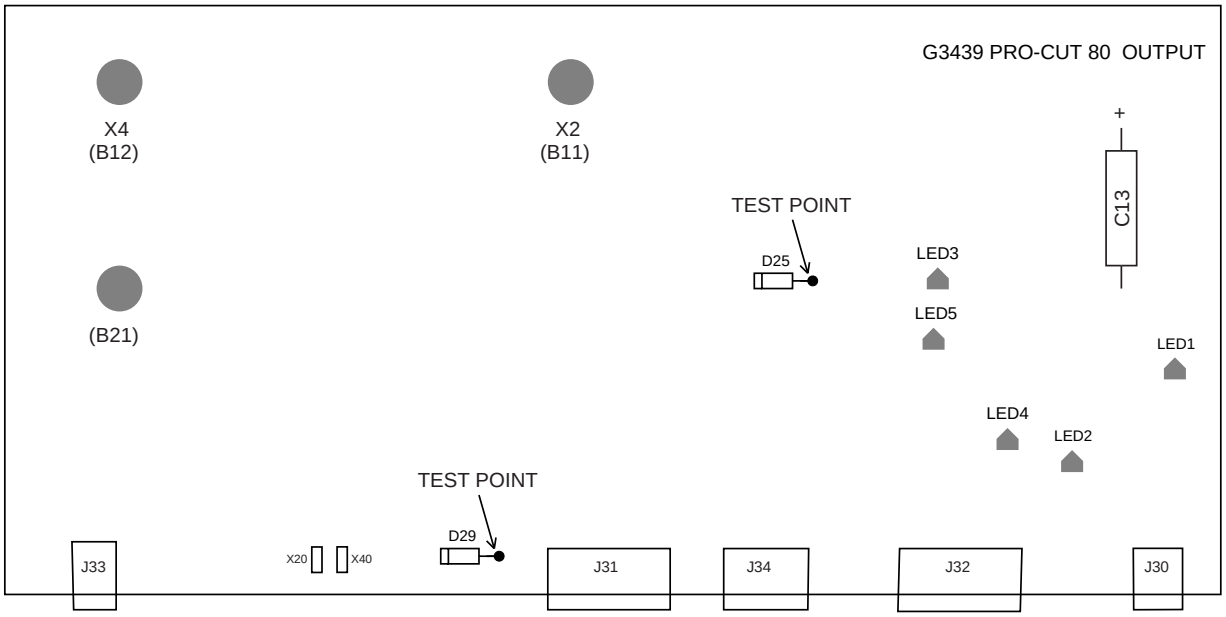
1. Remove input power to the machine.
2. Perform the ***Input Capacitor Discharge Procedure*** detailed earlier in this section.
3. Locate the air solenoid and leads. See Figure F.6.
4. Carefully remove plug J31 from the output power board. See Figure F.7.
5. Check the coil resistance of the solenoid at plug J31 pin-6 to J31 pin-5. Normal resistance is approximately 20 ohms. If the resistance is abnormal, check the continuity (zero or very low resistance) of leads #366 and #361 between the solenoid and plug J31.

   See the Wiring Diagram. If the leads are good, the solenoid coil may be faulty.
6. Carefully apply the 12 VDC supply to the solenoid leads at plug J31 (positive to J31 pin-6 lead #366 and negative to J31 pin-5 lead #361).

   With proper air pressure applied, the solenoid should activate and air should flow.

   If the solenoid activates but air does not flow, check for a restriction in the air line.
7. Install plug J31 back into the output power board.

FIGURE F.7 – PLUG J31 LOCATION



(T2) AUXILIARY TRANSFORMER TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

The test will determine if the auxiliary transformer is functional when the correct primary voltage is applied to the primary winding.

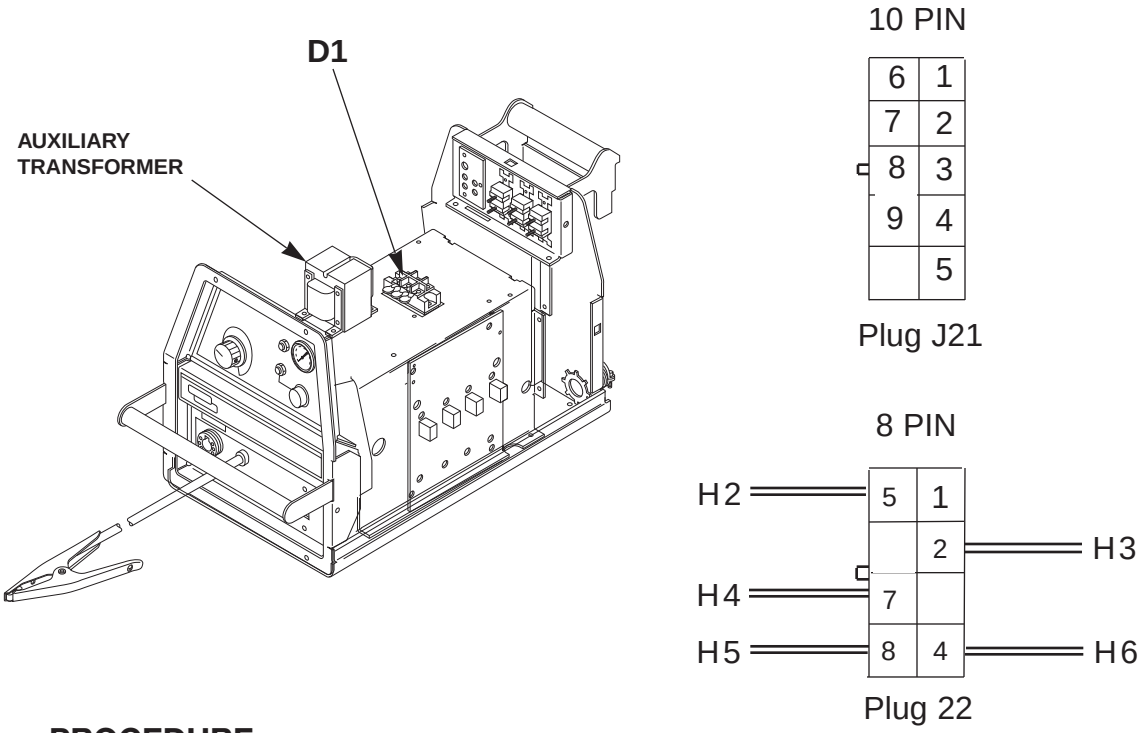
MATERIALS NEEDED

Volt/ohmmeter
Machine wiring diagram
5/16” Nut driver
230 VAC isolated power supply

This procedure takes approximately 18 minutes to perform.

(T2) AUXILIARY TRANSFORMER TEST *(continued)*

FIGURE F.8 – T2 AUXILIARY TRANSFORMER



PROCEDURE

1. Remove main input power to the PRO-CUT 80 machine.
2. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Locate the auxiliary transformer. See Fig. F.8
4. Locate and disconnect plugs J21 and J22 from the wiring harness. Cut any necessary cable ties. See Figure F.8.
5. Carefully apply the 230 VAC isolated supply to leads H1 located at the D1 input bridge (see wiring diagram) and H3 (2J22) of the auxiliary transformer.
6. Carefully check for the presence of the following primary and secondary voltages at the appropriate leads at plugs J21 and J22. See ***Figure F.8 and Table F.6..***

(T2) AUXILIARY TRANSFORMER TEST *(continued)*

TABLE F.6 - J21 AND J22 VOLTAGES

TEST POINT	TEST POINT	EXPECTED VOLTAGE
H1	H2 (5J22)	200 - 208VAC
H1	H4 (7J22)	380 - 415VAC
H1	H5 (8J22)	440 - 460VAC
Brown (8J21)	Brown (3J21)	12VAC
Red (2J21)	Red (6J21)	24VAC
Blue (9J21)	White (5J21)	18VAC
Blue (4J21)	White (5J21)	18VAC
Yellow (1J21)	Yellow (7J21)	115VAC

7. If the correct test voltages are present, the auxiliary transformer is good.
8. If any of the voltages are missing or very low with the proper primary voltage applied, the auxiliary transformer may be faulty.
9. If the auxiliary transformer tests good but it does not function when connected to the PRO-CUT 80, check the harness wiring to the auxiliary transformer. See the Wiring Diagram.
10. When finished with the test, replace plugs 21 and 22 and the case wraparound.

TRIGGER CIRCUIT TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

The procedure will help the technician determine if there is a problem or “fault” in the internal trigger circuit.

MATERIALS NEEDED

Ohmmeter/voltmeter (multimeter)
5/16” Nut driver
Simplified Trigger Circuit Diagram

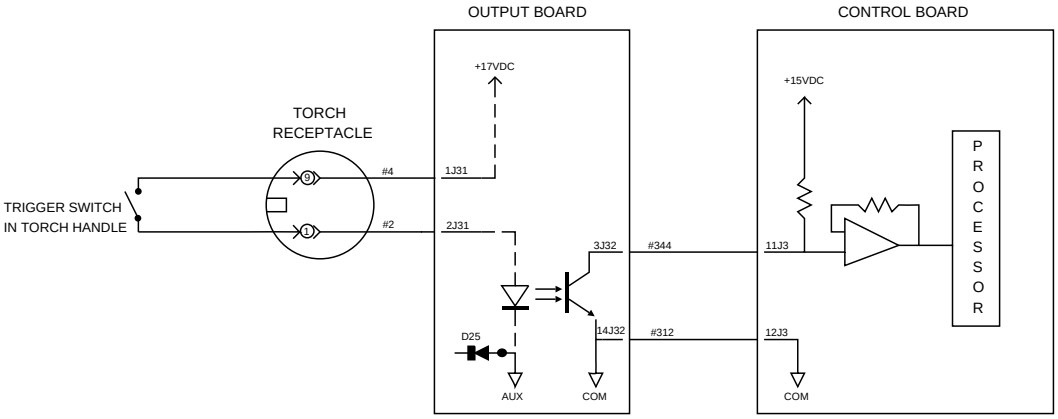
This procedure takes approximately 19 minutes to perform.

TROUBLESHOOTING & REPAIR

TRIGGER CIRCUIT TEST *(continued)*

FIGURE F.9 – SIMPLIFIED TRIGGER CIRCUIT DIAGRAM

SIMPLIFIED TRIGGER CIRCUIT



PROCEDURE

1. Remove input power to the PRO-CUT 80 machine.
2. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Locate the torch cable receptacle and leads #2 and #4. See Figure F.9, the Simplified Trigger Circuit Diagram. These leads are best accessed at plug J31 on the output board. See ***Figure F.10.***
4. Using the ohmmeter, check for continuity (less than one ohm) from lead #2 to lead #4. The torch trigger must be pulled and all input power removed from the machine. If continuity (less than one ohm) is **not** read, check the leads from plug J31 to the torch cable receptacle. Perform the ***Torch Continuity and Solenoid Test.***
5. If less than one ohm is read (only when the torch trigger is pulled), proceed to the next step. Also see ***Output Board LED Definitions*** and related figures.
6. Apply the correct input power to the PRO-CUT 80. Carefully check for approximately 17 VDC from plug J31 pin-1(lead#4) (positive) to plug J31 pin-2 (lead#2) (negative). See ***Figure F.10.*** If the correct voltage is not present, perform the ***Low Voltage Circuit Test.*** Also see ***Output Board LED Definitions*** and related figures.
7. If the correct voltage is present in Step 6, carefully check for the presence of approximately 15 VDC from plug J32 pin-3 (lead#354) (positive) to plug J32 pin-14 (lead#312) (negative). See ***Figure F.10.*** Also see ***Control Board LED Definitions*** and related figures. If the correct voltage is not present, perform the ***Low Voltage Circuit Test.***
8. If the correct voltage is present in the above test, carefully pull the torch trigger.

⚠ WARNING

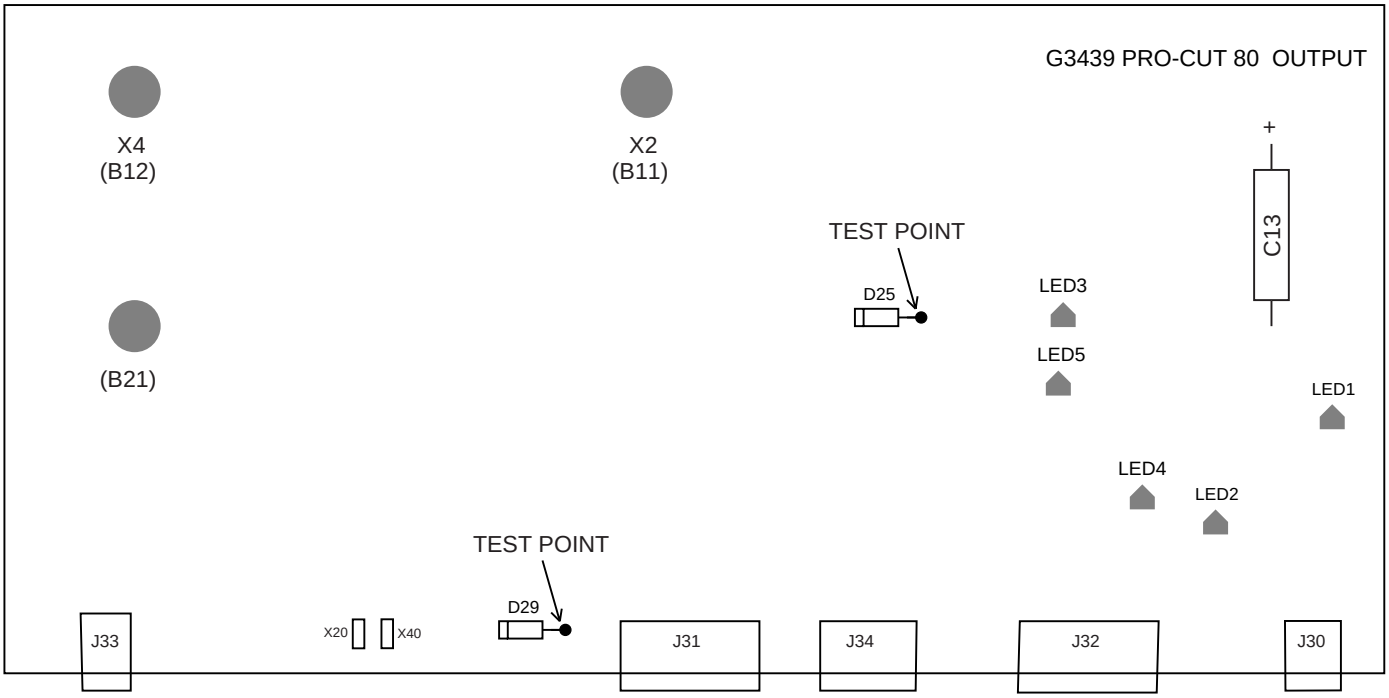
PILOT ARC, CUTTING ARC, AND HIGH VOLTAGE MAY BE PRESENT AT THE TORCH HEAD. Perform this test with the air input removed to avoid a pilot arc at the torch.

TRIGGER CIRCUIT TEST *(continued)*

9. With the torch trigger activated check the voltage at plug J32 pin-3 (lead#354) (positive) to plug J32 pin-14 (lead#312) (negative). Normal is less than 1 VDC. If more than 1 VDC is indicated, the power output board may be faulty. Release (deactivate) the torch trigger and remove input power to the PRO-CUT 80.
10. Perform the ***Input Filter Capacitor Discharge Procedure.***
11. Check the continuity of leads #354 and #312 between the output board and the control board. See ***Figure F.9,*** the ***Simplified Trigger Circuit Diagram,*** and ***Figure F.10***.
12. If all of the above checks are OK, the control board may be faulty. Replace.

TRIGGER CIRCUIT TEST *(continued)*

FIGURE F.10 - OUTPUT BOARD TRIGGER CIRCUIT TEST POINTS AND LEDS



PRO-CUT 80 OUTPUT BOARD LED DEFINITIONS

LED1: (Red) This light indicates that 24 VAC is being supplied to the output board from the auxiliary transformer. It also shows that the 24 VAC is being rectified to approximately 32 VDC. This DC voltage is used for the "parts-in-place" check for the torch circuit.

LED2: (Red) This light indicates that 12 VAC is being supplied to the output board from the auxiliary transformer. It also shows that the 12 VAC is being rectified to approximately 17 VDC. This DC voltage is used to power the trigger circuit and solenoid driver circuits incorporated on the output board.

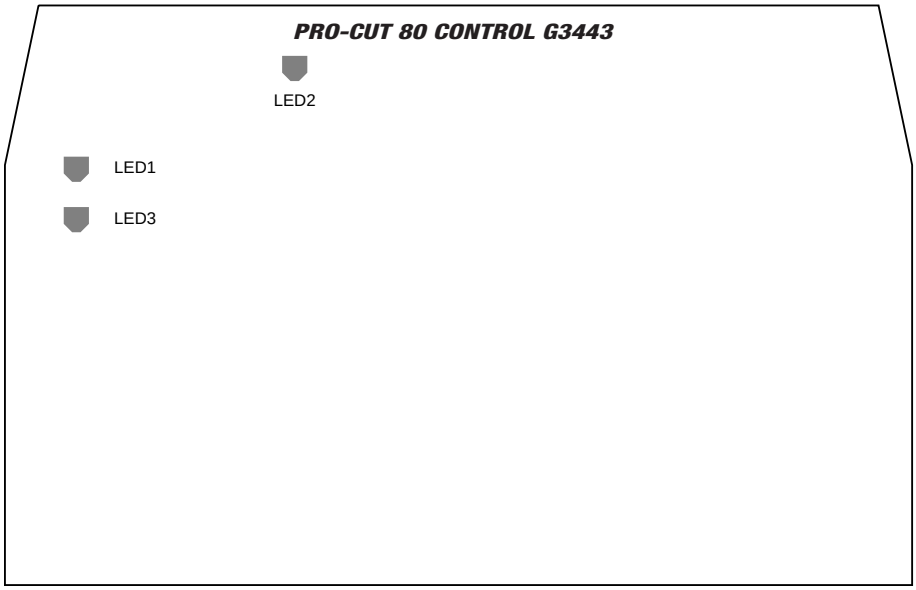
LED3: (Green) This light indicates that the air solenoid driver circuit is functioning. When this LED is lit, the air solenoid should be activated.

LED4: (Green) This light indicates that the trigger circuit on the output board has been activated. This LED should be lit when the torch or remote trigger is closed. This trigger circuit, on the output board, then sends a signal to the control board.

LED5: (Green) This light indicates that the electrode solenoid driver circuit is functioning. When this light is lit, the electrode solenoid should be activated. The electrode solenoid should be energized during gas (air) pre-flow time. During pilot and cutting arc periods, the LED should be off. When the arc goes out, the machine enters the post-flow state. Two seconds after the start of post-flow the electrode solenoid is activated a few times. The LED should blink to indicate this activity. The electrode solenoid will then be energized for the duration of post-flow. (The LED should be on.)

TRIGGER CIRCUIT TEST *(continued)*

FIGURE F.11 - CONTROL BOARD LEDs



CONTROL BOARD LED DEFINITIONS

LED1: (Red) This light indicates that 18 VAC is being supplied to the control board from the auxiliary transformer. It also shows that the 18 VAC is being rectified and should be regulated to +15 VDC. This +15 VDC supply is used to power the circuitry on the control board.

LED2: (Red) This light indicates that the +5.5 VDC is present. This voltage is derived from the +15 VDC supply. The +5.5 VDC supply is used to power the circuitry on the control board.

LED3: (Red) This light indicates that 18 VAC is being supplied to the control board from the auxiliary transformer. It also shows that the 18 VAC is being rectified and should be regulated to -15 VDC. This -15 VDC supply is used to power the circuitry on the control board.

LOW VOLTAGE CIRCUIT TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

These voltage checks will help the technician determine if the correct voltages are being applied and processed by the various P.C. boards. Some of the voltage verification test points are not easily accessible. The presence of these voltages can also be confirmed by LEDs on the various P.C. boards.

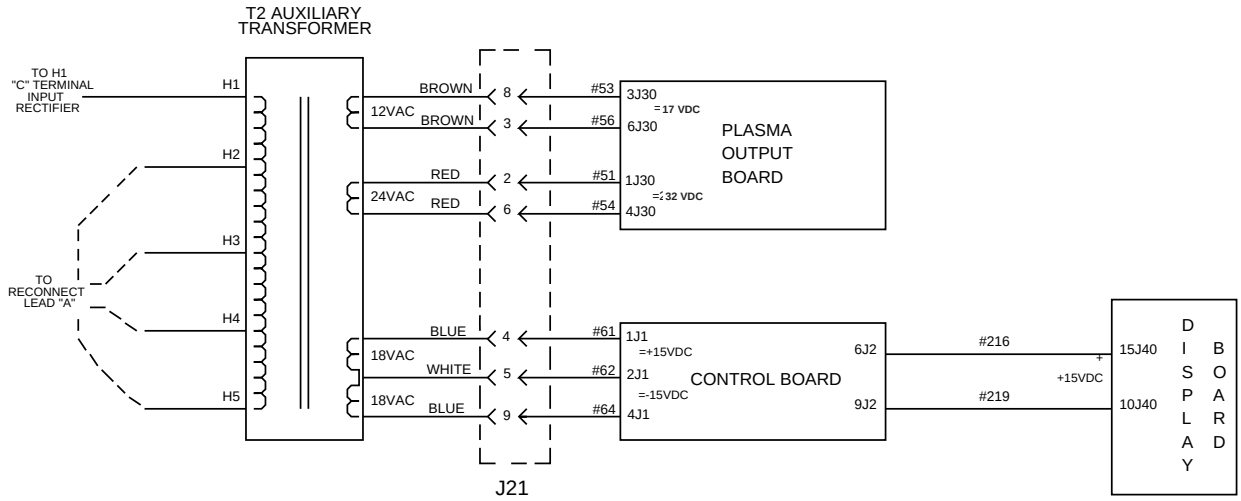
MATERIALS NEEDED

5/16” Nut driver
Volt/ohmmeter (multimeter)

This procedure takes approximately 20 minutes to perform.

LOW VOLTAGE CIRCUIT TEST *(continued)*

FIGURE F.12 - LOW VOLTAGE CIRCUIT DIAGRAM



PROCEDURE

1. Remove input power to the PRO-CUT 80 machine.
2. Using the 5/16" nutdriver remove the case wraparound cover.

⚠ WARNING

ELECTRIC SHOCK can kill.

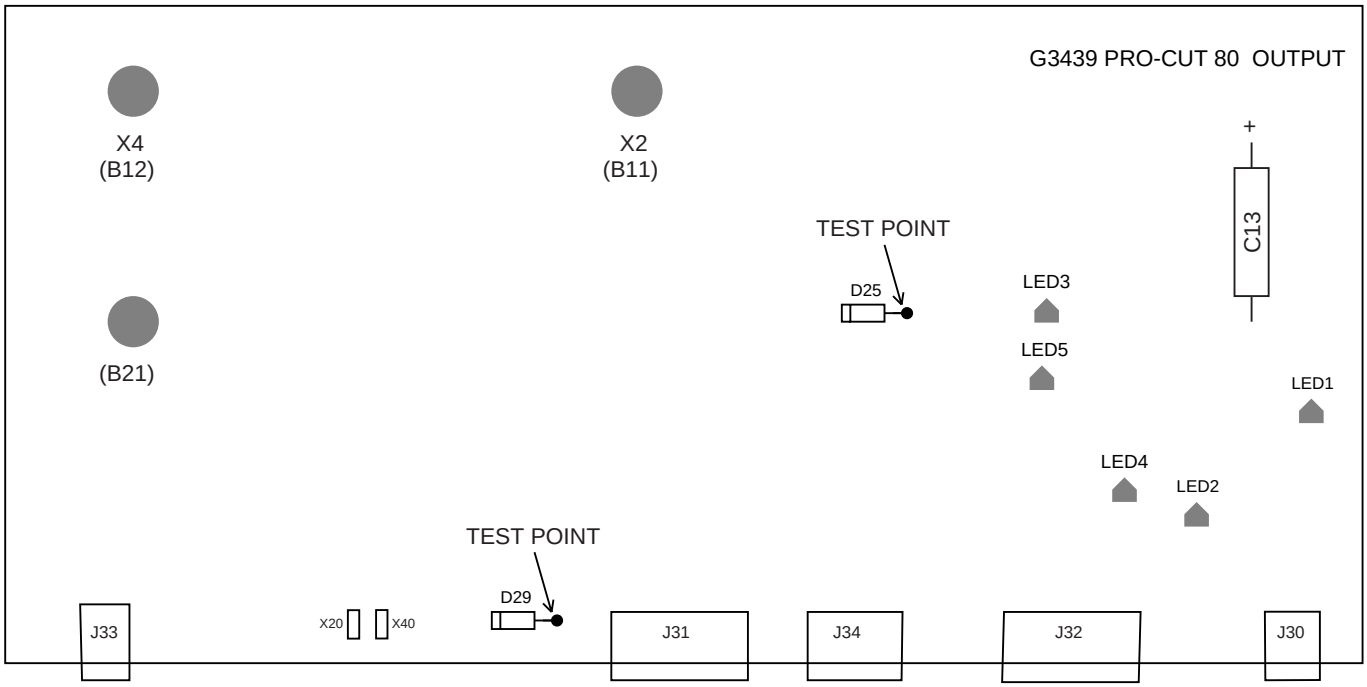
- Do not touch electrically hot parts.

3. Apply the correct input power to the machine and carefully check for the following voltages.
4. Check for the presence of approximately 32 VDC on the output board.
   a. LED1 should be lit when 32 VDC is present. See ***Figure F.13.*** See ***Output Board LED Definitions*** and ***Figure F.12, Low Voltage Circuit Diagram.***
   b. To verify the presence of 32 VDC, check across capacitor C13. Make certain the voltmeter probes make good contact with the capacitor leads. See ***Figure F.13.***
5. Check for the presence of 17 VDC on the output board.
   a. LED2 should be lit when 17 VDC is present. See ***Figure F.13.*** See ***Output Board LED Definitions*** and ***Figure F.12, Low Voltage Circuit Diagram.***
   b. To verify the presence of 17 VDC, check from plug J31 Pin-6 to diode D25 (anode). See ***Figure F.13.*** Make certain the voltmeter probes make good contact with pin-6 and the diode anode lead. It will be necessary to penetrate the silicon sealant.
6. Check for the presence of +15 VDC on the control board.
   a. LED1 should be lit when +15 VDC is present. See ***Figure F.13.*** See ***Control Board LED Definitions*** and ***Figure F.12, Low Voltage Circuit Diagram.***
7. Check for the presence of -15 VDC on the control board.
   a. LED3 should be lit when -15 VDC is present. See Figure ***F.13.*** See Control Board LED Definitions and ***Figure F.12, Low Voltage Circuit Diagram.***

8. Check for the presence of +5 VDC on the control board.
   a. LED2 should be lit when +5 VDC is present. See ***Figure F.14.*** See ***Control Board LED Definitions*** and ***Figure F.12, Low Voltage Circuit Diagram.***
9. Check for the presence of +15 VDC being applied to the display board from the control board. You may have to remove the display board to check it.
   a. +15 VDC should be present at leads #216(+) to #219(-). See ***Figure F.15*** and ***Figure F.12, Low Voltage Circuit Diagram.***
10. If any of the DC supply voltages are incorrect or missing, make certain the correct AC supply voltages are being applied to the P.C. boards. See ***Figure F.12, Low Voltage Circuit Diagram*** and ***(T2) Auxiliary Transformer Test.***
11. When the test is complete, remove input power and replace the case wraparound cover.

LOW VOLTAGE CIRCUIT TEST *(continued)*

FIGURE F.13 – OUTBOARD LOW VOLTAGE CIRCUIT TEST POINTS AND LEDs



PRO-CUT 80 OUTPUT BOARD LED DEFINITIONS

LED1: (Red) This light indicates that 24 VAC is being supplied to the output board from the auxiliary transformer. It also shows that the 24 VAC is being rectified to approximately 28 VDC. This DC voltage is used for the "parts-in-place" check for the torch circuit.

LED2: (Red) This light indicates that 12 VAC is being supplied to the output board from the auxiliary transformer. It also shows that the 12 VAC is being rectified to approximately 17 VDC. This DC voltage is used to power the trigger circuit and solenoid driver circuits incorporated on the output board.

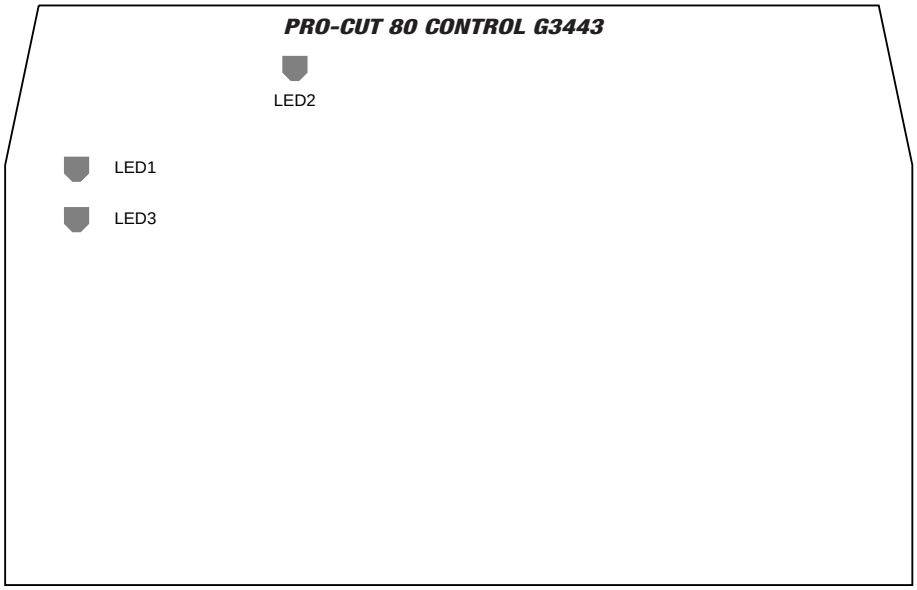
LED3: (Green) This light indicates that the air solenoid driver circuit is functioning. When this LED is lit, the air solenoid should be activated.

LED4: (Green) This light indicates that the trigger circuit on the output board has been activated. This LED should be lit when the torch or remote trigger is closed. This trigger circuit, on the output board, then sends a signal to the control board.

LED5: (Green) This light indicates that the electrode solenoid driver circuit is functioning. When this light is lit, the electrode solenoid should be activated. The electrode solenoid should be energized during gas (air) pre-flow time. During pilot and cutting arc periods, the LED should be off. When the arc goes out, the machine enters the post-flow state. Two seconds after the start of post-flow the electrode solenoid is activated a few times. The LED should blink to indicate this activity. The electrode solenoid will then be energized for the duration of post-flow. (The LED should be on).

LOW VOLTAGE CIRCUIT TEST *(continued)*

FIGURE F.14 – CONTROL BOARD LEDs



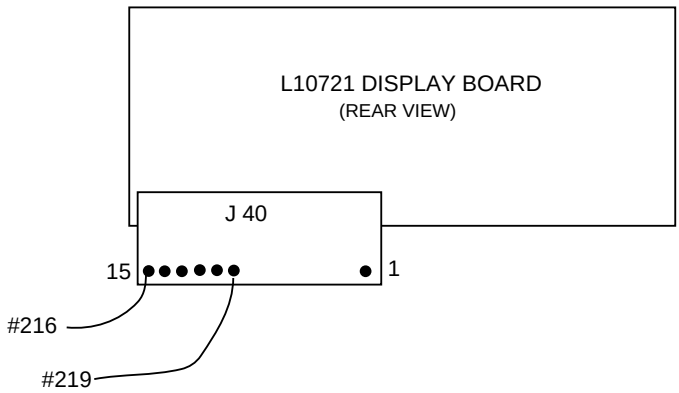
CONTROL BOARD LED DEFINITIONS

LED1: (Red) This light indicates that 18 VAC is being supplied to the control board from the auxiliary transformer. It also shows that the 18 VAC is being rectified and should be regulated to +15 VDC. This +15 VDC supply is used to power the circuitry on the control board.

LED2: (Red) This light indicates that the +5.5 VDC is present. This voltage is derived from the +15 VDC supply. The +5.5 VDC supply is used to power the circuitry on the control board.

LED3: (Red) This light indicates that 18 VAC is being supplied to the control board from the auxiliary transformer. It also shows that the 18 VAC is being rectified and should be regulated to -15 VDC. This 15 VDC supply is used to power the circuitry on the control board.

FIGURE F.15 – DISPLAY BOARD TEST POINTS



CONTROL BOARD REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

The following procedure will aid the technician in removing the control board for maintenance or replacement.

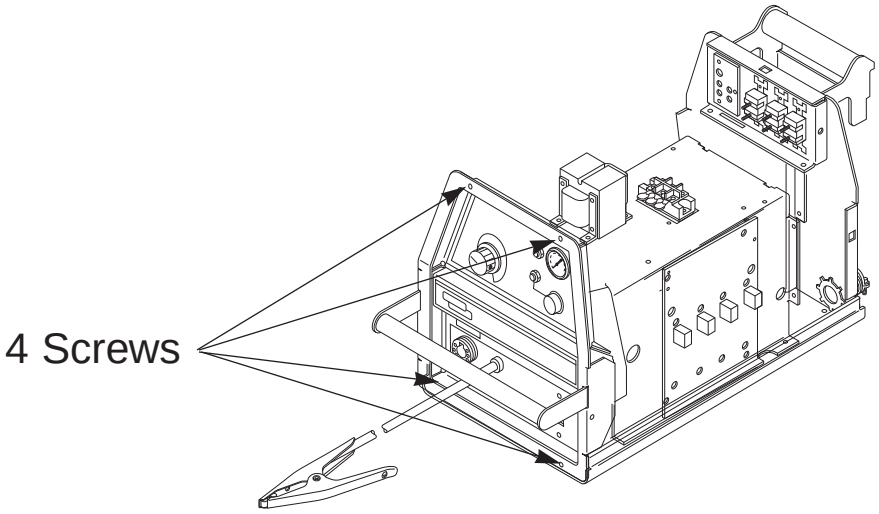
MATERIALS NEEDED

5/16” Nut driver
Needle-nose pliers

This procedure takes approximately 15 minutes to perform.

CONTROL BOARD REMOVAL AND REPLACEMENT *(continued)*

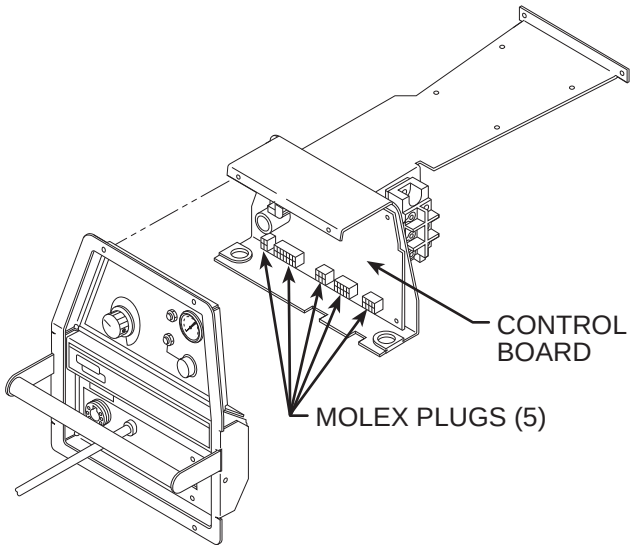
FIGURE F.16 - CASE FRONT SCREW REMOVAL



PROCEDURE

1. Remove input power to the PRO-CUT 80 machine.
2. Remove the wraparound cover and perform the ***Input Filter Discharge Procedure*** detailed earlier in this section.
3. Using the 5/16" nut driver, remove the four screws holding the front assembly to the top and base of the machine. See Figure F.16.
4. Carefully slide (do not force) the front away from the rest of the machine about one inch. This will allow more "working" room to remove the control board.

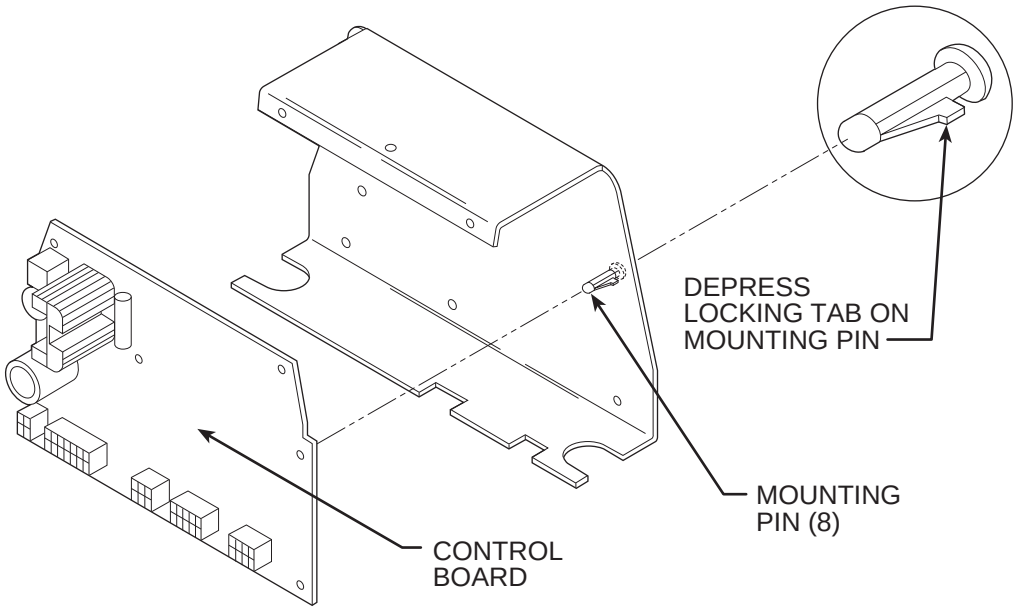
FIGURE F.17 - CONTROL BOARD MOLEX PLUG REMOVAL



CONTROL BOARD REMOVAL AND REPLACEMENT *(continued)*

5. Locate the control board and the five molex type plugs connected to it. See ***Figure F.17.***
6. Carefully remove the five molex type plugs by depressing the locking tabs and gently extracting the plugs from the P.C. board receptacles.

FIGURE F.18 - CONTROL BOARD REMOVAL FROM MOUNTING PINS



7. Using the needle-nose pliers and screwdriver, gently remove the control board from the eight mounting pins by depressing the tabs on the mounting pins and carefully removing the board from the pins. See ***Figure F.18.***

CAUTION

Be sure to follow the recommended static-free methods for handling printed circuit boards. Failure to do so can result in permanent damage to the equipment.

8. When replacing the control board, align the mounting holes with the eight mounting pins and gently slide the P.C. board onto the mounting pins until the board “snaps” onto the pins.
9. Replace the five molex type plugs in their respective receptacles. Be certain they are securely in place.
10. Carefully reposition the front assembly in place and install the four mounting screws previously removed.
11. Inspect, clear and secure all leads before installing the case wrap-around reassembly.
12. Using the 5/16” nut driver, install the case wraparound.

DISPLAY BOARD REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call or 1-800-833-9353 (WELD).

DESCRIPTION

The following procedure will aid the technician in removing the display board for maintenance or replacement.

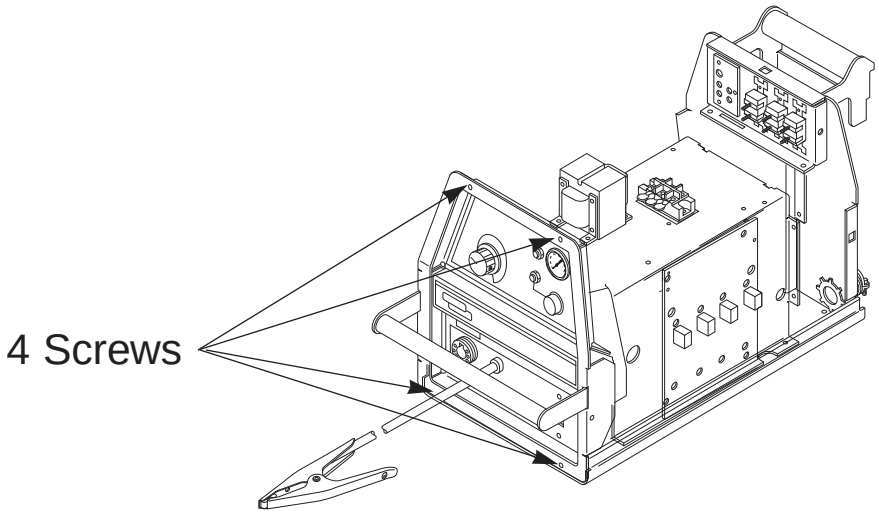
MATERIALS NEEDED

5/16” Nut driver
Screw driver

This procedure takes approximately 15 minutes to perform.

DISPLAY BOARD REMOVAL & REPLACEMENT *(continued)*

FIGURE F.19 - CASE FRONT SCREW REMOVAL

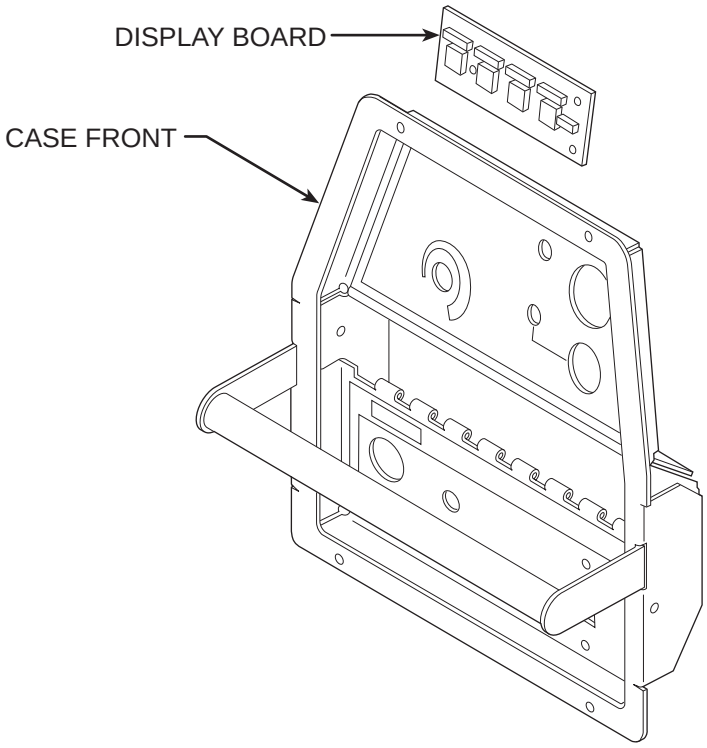


PROCEDURE

1. Remove the input power to the PRO-CUT 80 machine.
2. Remove the wraparound cover and perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Using the 5/16” nut driver, remove the four screws holding the front assembly to the top and base of the machine. See Figure F.19.
4. Carefully slide (do not force) the front away from the rest of the machine about one inch. This will allow more “working” room to remove the display board.

DISPLAY BOARD REMOVAL & REPLACEMENT *(continued)*

FIGURE F.20 – DISPLAY BOARD REMOVAL



5. Locate the display P.C. board and the one plug connected to it. See Figure F.20.
6. Gently remove the display P.C. board from the three mounting pins.

⚠ CAUTION

Be sure to follow the recommended static-free methods for handling printed circuit boards. Failure to do so can result in permanent damage to the equipment.

7. Depress the locking tab and remove the plug connector from the display board.
8. When replacing the display board, carefully connect the plug into the board. Make certain the plug is secure and the locking tab is in place.
9. Align the display board with the three mounting pins and slide the display board into place.
10. Carefully reposition the front assembly in place and install the four mounting screws previously removed.
11. Inspect, clear and secure all leads in preparation for the case wraparound reassembly.
12. Using the 5/16” nut driver, install the case wraparound.

TROUBLESHOOTING & REPAIR

OUTPUT POWER BOARD REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

The following procedure will aid the technician in removing the output power board for maintenance or replacement.

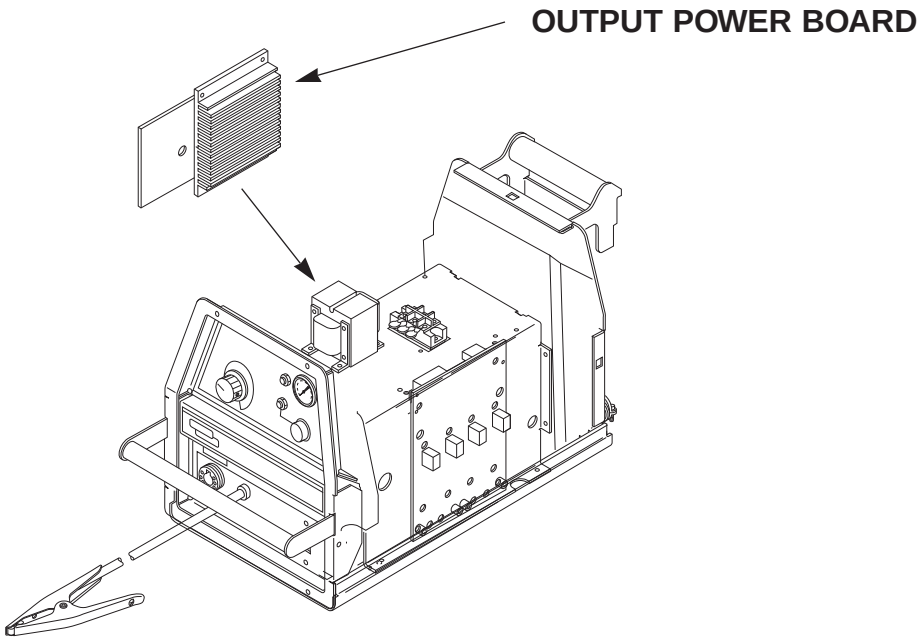
MATERIALS NEEDED

5/16” Nut driver
3/16” Allen type wrench
7/16” Wrench
Penetrox A-13 (Lincoln E2529) Electrical Joint Compound
Phillips head screw driver
Torque wrench

This procedure takes approximately 25 minutes to perform.

OUTPUT POWER BOARD REMOVAL & REPLACEMENT *(continued)*

FIGURE F.21 – OUTPUT POWER BOARD REMOVAL

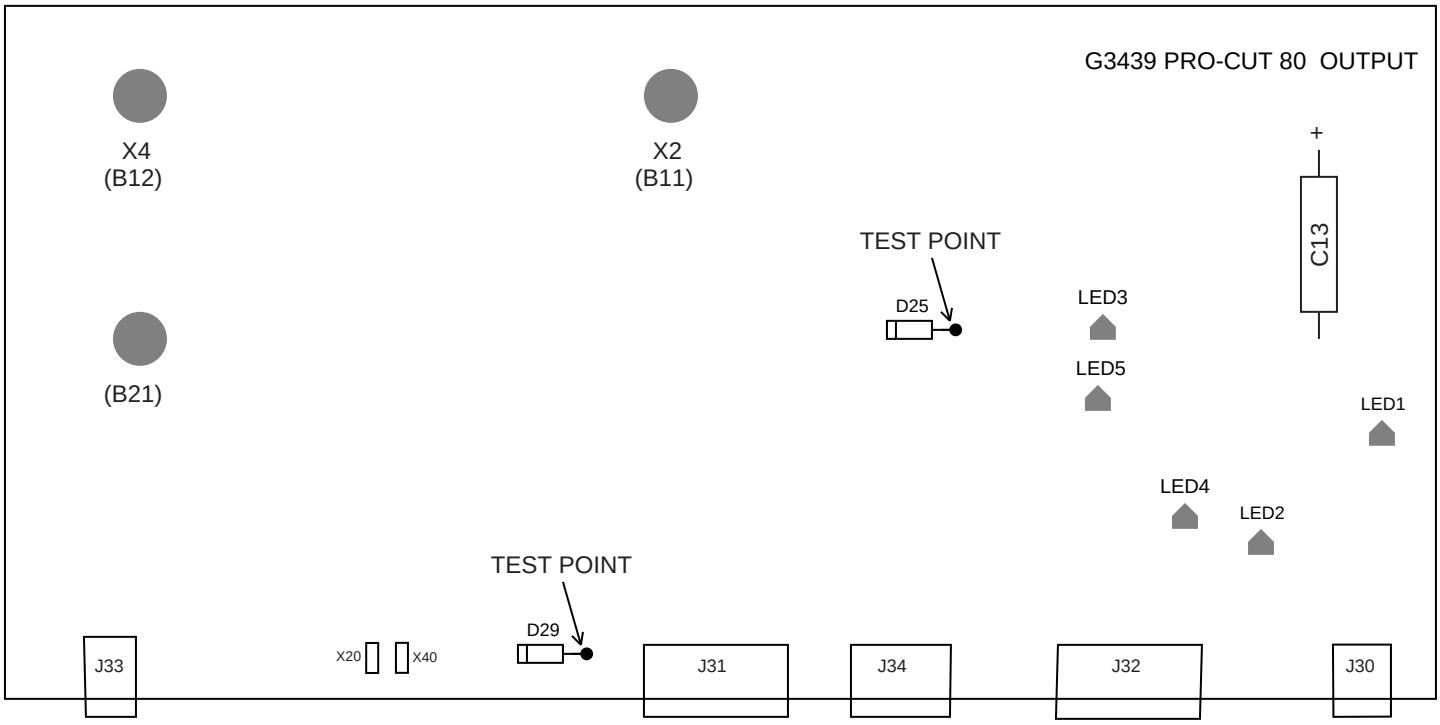


PROCEDURE

1. Remove input power to the PRO-CUT 80 machine.
2. Remove the case wraparound and perform the ***Input Capacitor Filter Discharge Procedure*** detailed earlier in this section.
3. Locate the output power P.C. board and associated lead and plug connections. See Figures F.21 and ***F.22.***

OUTPUT POWER BOARD REMOVAL & REPLACEMENT *(continued)*

FIGURE F.22 – OUTPUT BOARD LEAD LOCATIONS



4. Using the 7/16” wrench, remove leads X4, X2 and B21 from the output power board.
5. Remove plugs J30, J31, J32, J33, and J34 from the output power board.
6. Remove leads X20 and X40 from the output power board.
7. Using the phillips head screw driver, remove the four screws from the lower + upper left and right corners of the output power board.
8. Using the 3/16” allen head wrench, remove the four socket screws mounting the output power board to the heat sink.
9. Carefully remove the output power board from the heat sink.

⚠ CAUTION

Be sure to follow the recommended static-free methods for handling printed circuit boards. Failure to do so can result in permanent damage to the equipment.

REPLACEMENT PROCEDURE

1. Apply a thin coating of Penetrox A-13 Electrical Joint Compound to the mating surfaces of the output power board and the heat sink. Make sure the surfaces are clean. Do not allow the compound to get into the threaded holes or on the screw threads.

⚠ CAUTION

Be sure to follow the recommended static-free methods for handling printed circuit boards. Failure to do so can result in permanent damage to the equipment.

2. Mount the output power board to the heat sink and pre-torque the four socket head screws to 25 inch-pounds.
3. Finish tightening the four screws to 40-48 inch-pounds.
4. Replace the four phillips head screws previously removed.
5. Replace leads X20 and X40.
6. Replace plugs J30, J31, J32, J33, and J34.
7. Replace leads X4 and X2, then torque to 75 IN. LBS.
8. Replace lead B21 and torque it to 75 IN. LBS.
9. Clear and secure all leads and replace the wraparound cover.

PRIMARY POWER BOARD AND FILTER CAPACITOR REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

The following procedure will aid the technician in removing the primary power board and filter capacitors for maintenance or replacement.

MATERIALS NEEDED

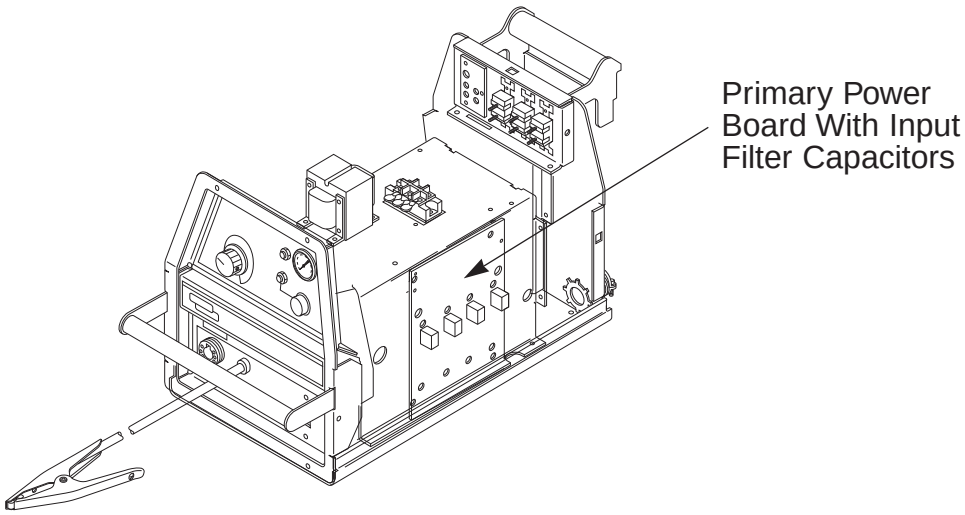
5/16” Nut driver
3/16” Allen type wrench
7/16” Wrench
Phillips Head screw driver
Torque wrench
3/8” Wrench
Penetrox A-13 (Lincoln E2529) Electrical Joint Compound

This procedure takes approximately 40 minutes to perform.

TROUBLESHOOTING & REPAIR

PRIMARY POWER BOARD AND FILTER CAPACITOR REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.23 – PRIMARY POWER BOARD REMOVAL

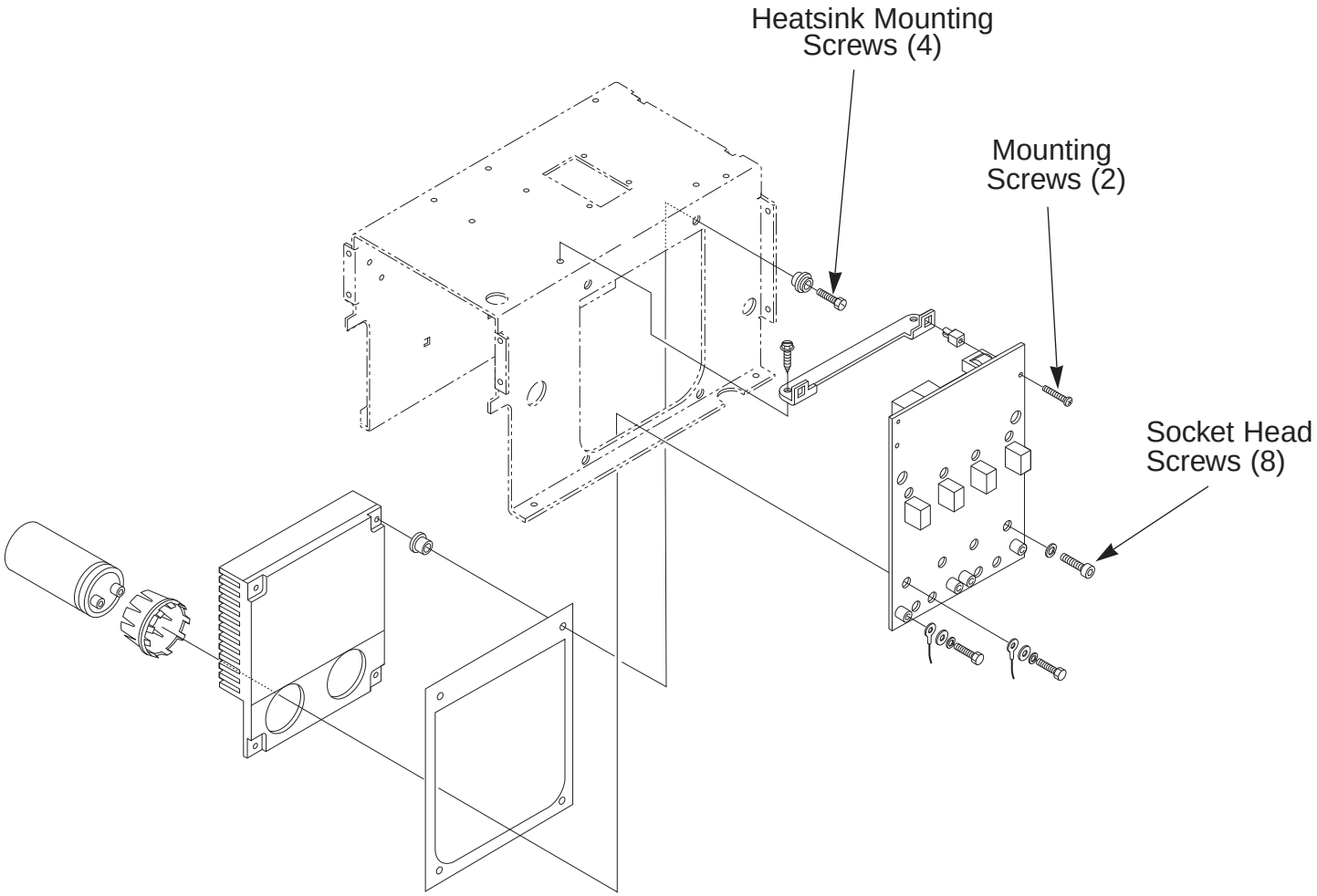


REMOVAL PROCEDURE

1. Remove input power from the PRO-CUT 80 machine.
2. Remove the case wraparound and perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Locate the primary power board and associated lead and plug connections. See Figure F.23.
4. Label the leads for reassembly.
5. Remove Plug J10 and any necessary cable ties.
6. Using the 7/16” wrench, remove leads 201, 202, 203, 204, 205, 206, 207, 208 and 209.

PRIMARY POWER BOARD AND FILTER CAPACITOR REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.24 – POWER BOARD HEATSINK AND CAPACITOR REMOVAL



7. Using the Phillips Head screw driver, remove the two mounting screws from the top right of the primary power board. See Figure F.24.
8. Using the 3/16" allen type wrench, remove the eight socket head screws and lock washers mounting the primary power board to the heat sink.
9. Carefully remove the primary power board from the heat sink.

⚠ CAUTION

Be sure to follow the recommended static-free methods for handling printed circuit boards. Failure to do so can result in permanent damage to the equipment.

PRIMARY POWER BOARD AND FILTER CAPACITOR REMOVAL AND REPLACEMENT *(continued)*

CAPACITOR REMOVAL

1. Using the 3/8" wrench, remove the four screws holding the heat sink to the center panel assembly. **Take note of the insulator placement for reassembly.** The four screws have insulating washers on both sides of the panel assembly. These must be properly replaced upon reassembly.
2. Carefully push the heat sink in towards the center of the machine. This is necessary to gain clearance for capacitor(s) removall.
3. Carefully slide the capacitor(s) from the heat sink assembly. **Observe polarity markings and terminal position.**

CAPACITOR REPLACEMENT AND P.C. BOARD REPLACEMENT

1. Carefully slide the new capacitor(s) into the heat sink assembly.
2. Reassemble the heat sink assembly to the center panel using the four screws and insu lated washers previously removed. **Note insulation placement.**
3. Position the capacitors to the P.C.Board for assembly. **Note the polarity of the capacitors.**
4. Apply a thin coating of Penetrox A-13 Electrical Joint Compound to the mating surfaces of the P.C. board and the heat sink and capacitor terminals.
5. Mount the P.C. board to the heat sink and capacitor assembly. Make sure the capacitor terminals line up with the holes in the P.C. board and with the correct capacitor polarities.
6. Assemble the eight socket head screws and pre-torque them to 25 inch-pounds.
7. Make certain the capacitors are lined up correctly so that when the capacitor bolts are assembled through the P.C. board, there will NOT be any distortion to the P.C. board.
8. Finish tightening the eight screws to 40-48 inch-pounds.
9. Assemble the two Phillips Head screws previously removed.
10. Connect the J10 plug.
11. Connect leads 201, 204, 205, 208 and 209 previously removed. Torque to 75 IN. LBS.
12. Connect leads 202A, 207A, 206, and 203A to the capacitor terminals. Torque to 50-60 inch-pounds.
13. Clear and reposition any leads that may be disturbed. Replace wire ties.
14. Replace the case wraparound cover.

INPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

DESCRIPTION

The following procedure will aid the technician in removing the input rectifier bridge for maintenance or replacement.

MATERIALS NEEDED

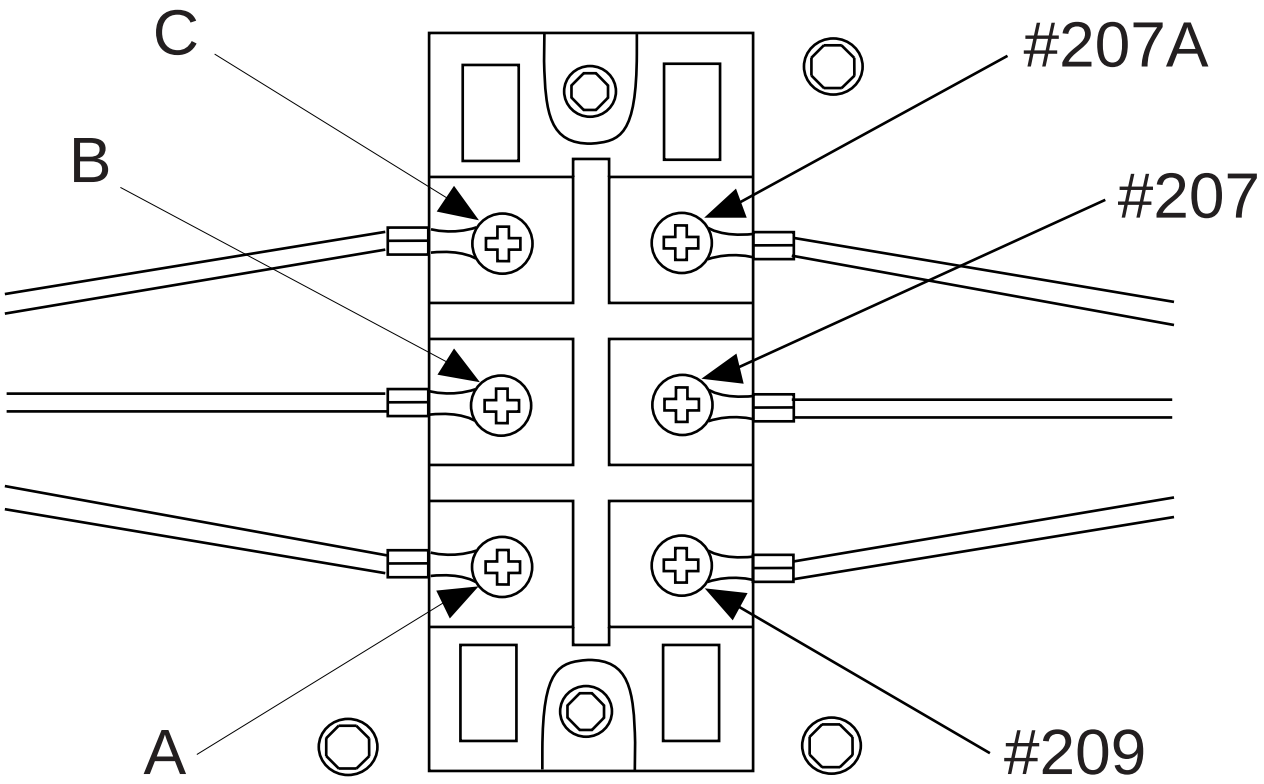
3/16” Allen type wrench
Phillips head screw driver
Torque wrench
Penetrox A13 (Lincoln E2529) Electrical Joint Compound
Dow Corning 738 (Lincoln E2861) Electrical Insulating Compound

This procedure takes approximately 16 minutes to perform.

INPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT *(continued)*

PROCEDURE

1. Remove input power to the PRO-CUT 80.
2. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
3. Locate the input rectifier and the leads connected to it. See Figure F.25.
4. Identify and mark the leads connected to the rectifier terminals.
5. With the phillips head screw driver, remove the lead terminals connected to the rectifier terminals.
6. Using the 3/16" allen wrench, remove the two cap head screws and washers mounting the input rectifier bridge to the center panel assembly.



TOP VIEW

FIGURE F.25 – INPUT RECTIFIER LEAD LOCATIONS

INPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT *(continued)*

7. Carefully remove the input rectifier bridge.
8. When installing a new input rectifier apply a thin coating of Penetrox A-13 Heat Sink Compound (Lincoln E2529) to the mating surfaces. Torque the mounting cap screws and nuts to 44 in-lbs.
9. Reconnect the 10 leads to the correct terminals and torque the phillips head screws to 31 in-lbs.
10. Apply Dow Corning 738 Insulating Compound to all six screw heads and terminals. The heavy input lead terminals should be against the rectifier terminals.
11. Assemble case wrap-around cover.

TROUBLESHOOTING & REPAIR

RETEST AFTER REPAIR

Should a machine under test be rejected for any reason requiring the removal of any mechanical part that could affect the machine's electrical characteristics, or if any electrical components are repaired or replaced, the machine must be retested.

INPUT IDLE AMPS AND WATTS

Input Volts/Hertz	Idle Amps	Idle Watts
208/230/460	0.61	140

Output Current Range	**35 - 85 Amps**

Maximum Open Circuit Voltage	**335 Volts**

F-58

NOTES

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-ELECTRICAL DIAGRAMS SECTION-

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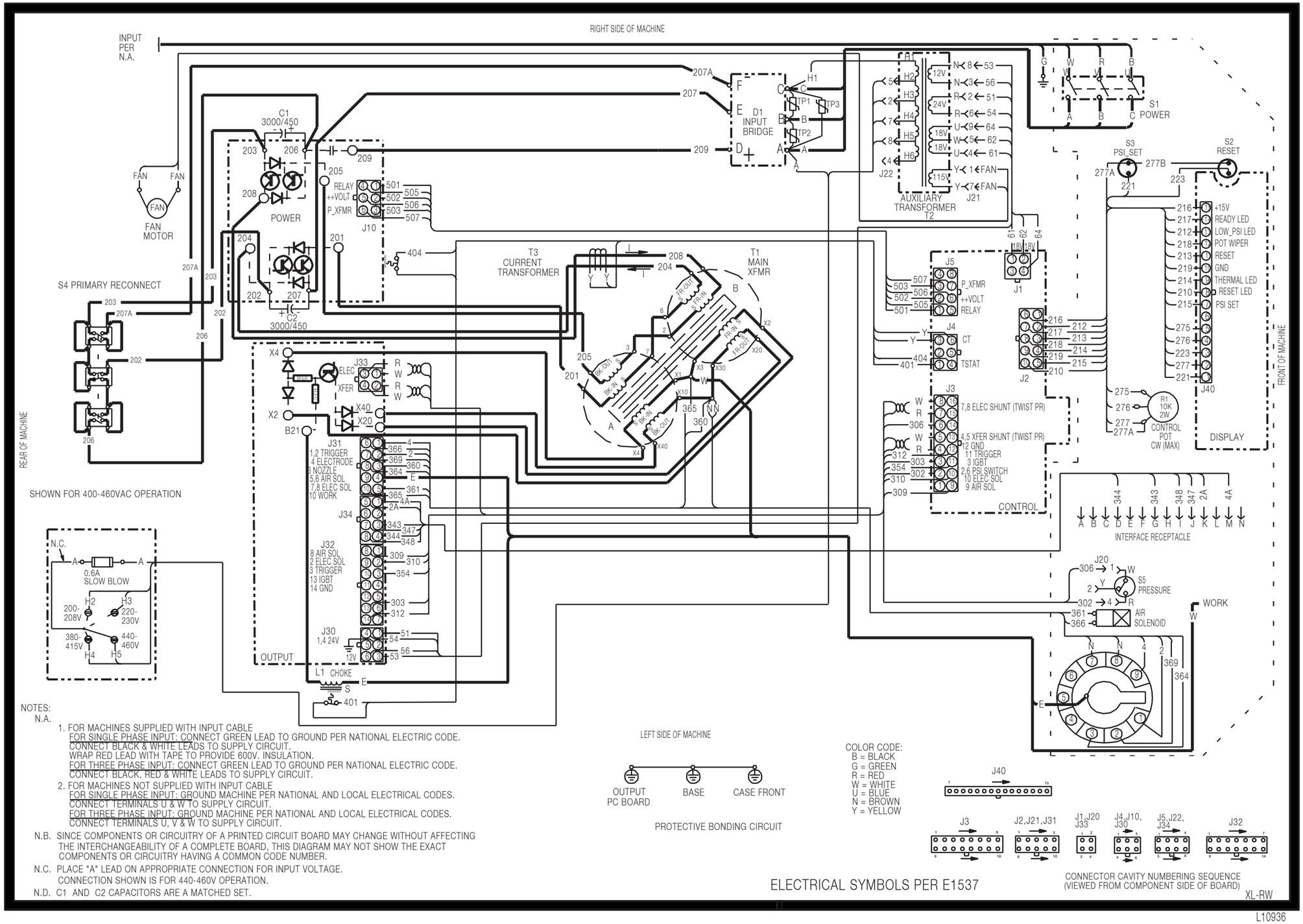
WIRING DIAGRAM - PRO CUT 80



NOTES:
N.A.

1. FOR MACHINES SUPPLIED WITH INPUT CABLE
   FOR SINGLE PHASE INPUT: CONNECT GREEN LEAD TO GROUND PER NATIONAL ELECTRIC CODE.
   CONNECT BLACK & WHITE LEADS TO SUPPLY CIRCUIT.
   WRAP RED LEAD WITH TAPE TO PROVIDE 600V. INSULATION.
   FOR THREE PHASE INPUT: CONNECT GREEN LEAD TO GROUND PER NATIONAL ELECTRIC CODE.
   CONNECT BLACK, RED & WHITE LEADS TO SUPPLY CIRCUIT.
2. FOR MACHINES NOT SUPPLIED WITH INPUT CABLE
   FOR SINGLE PHASE INPUT: GROUND MACHINE PER NATIONAL AND LOCAL ELECTRICAL CODES.
   CONNECT TERMINALS U & W TO SUPPLY CIRCUIT.
   FOR THREE PHASE INPUT: GROUND MACHINE PER NATIONAL AND LOCAL ELECTRICAL CODES.
   CONNECT TERMINALS U, V & W TO SUPPLY CIRCUIT.

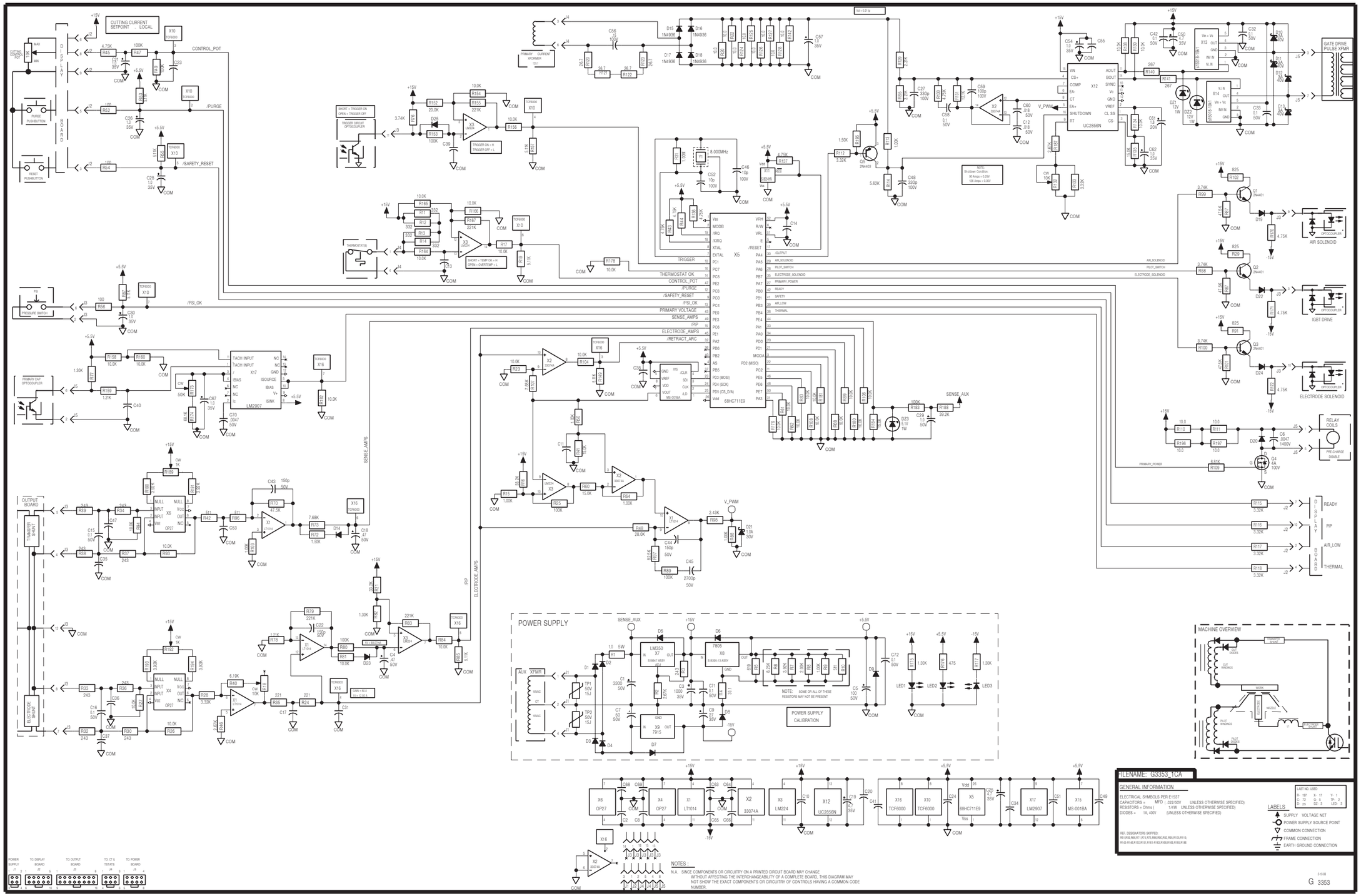
N.B. SINCE COMPONENTS OR CIRCUITRY OF A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY HAVING A COMMON CODE NUMBER.

N.C. PLACE "A" LEAD ON APPROPRIATE CONNECTION FOR INPUT VOLTAGE.
CONNECTION SHOWN IS FOR 440-460V OPERATION.

N.D. C1 AND C2 CAPACITORS ARE A MATCHED SET.

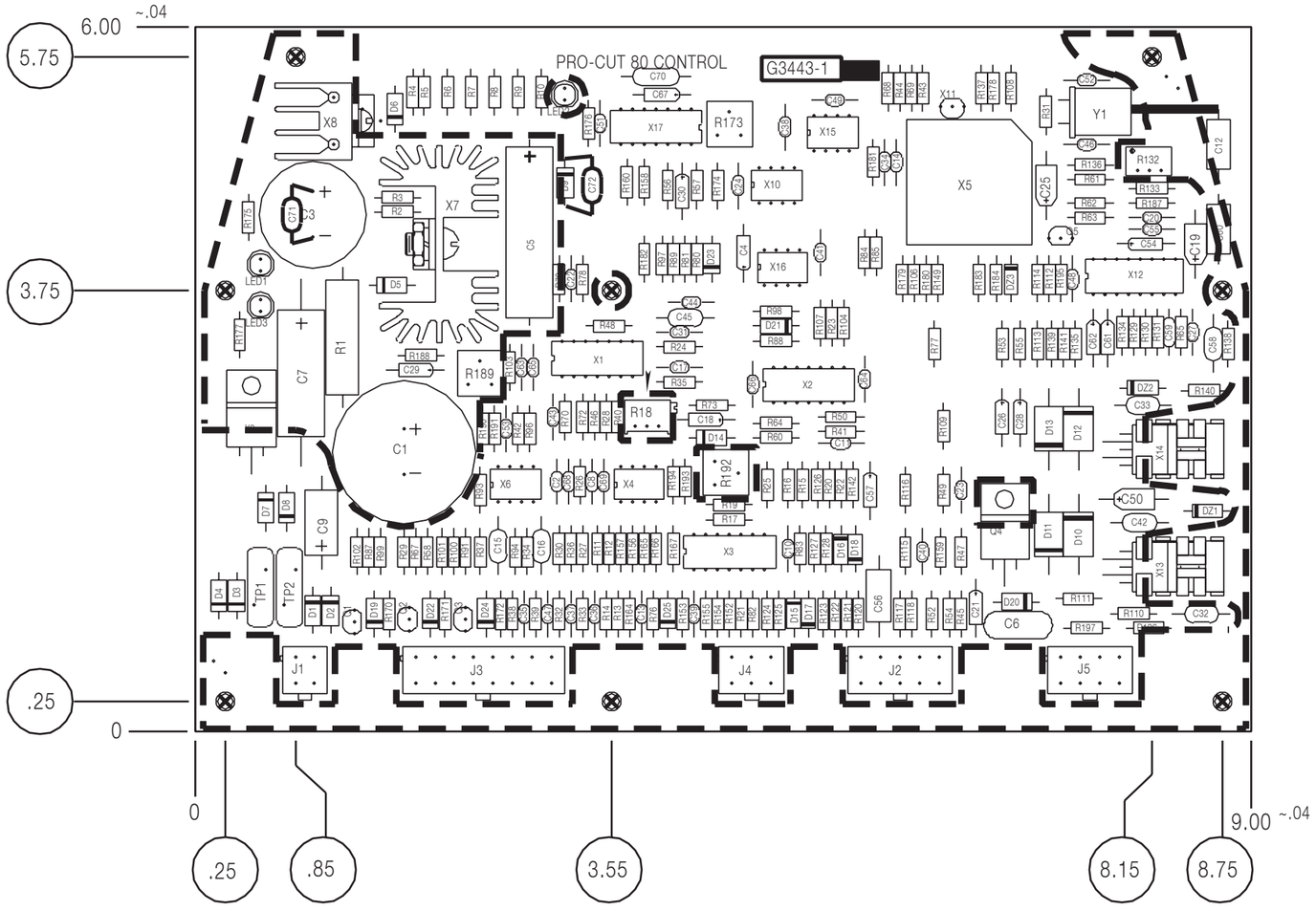
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

SCHEMATIC - CONTROL PC BOARD



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - CONTROL BOARD (CODE 10574 ONLY)



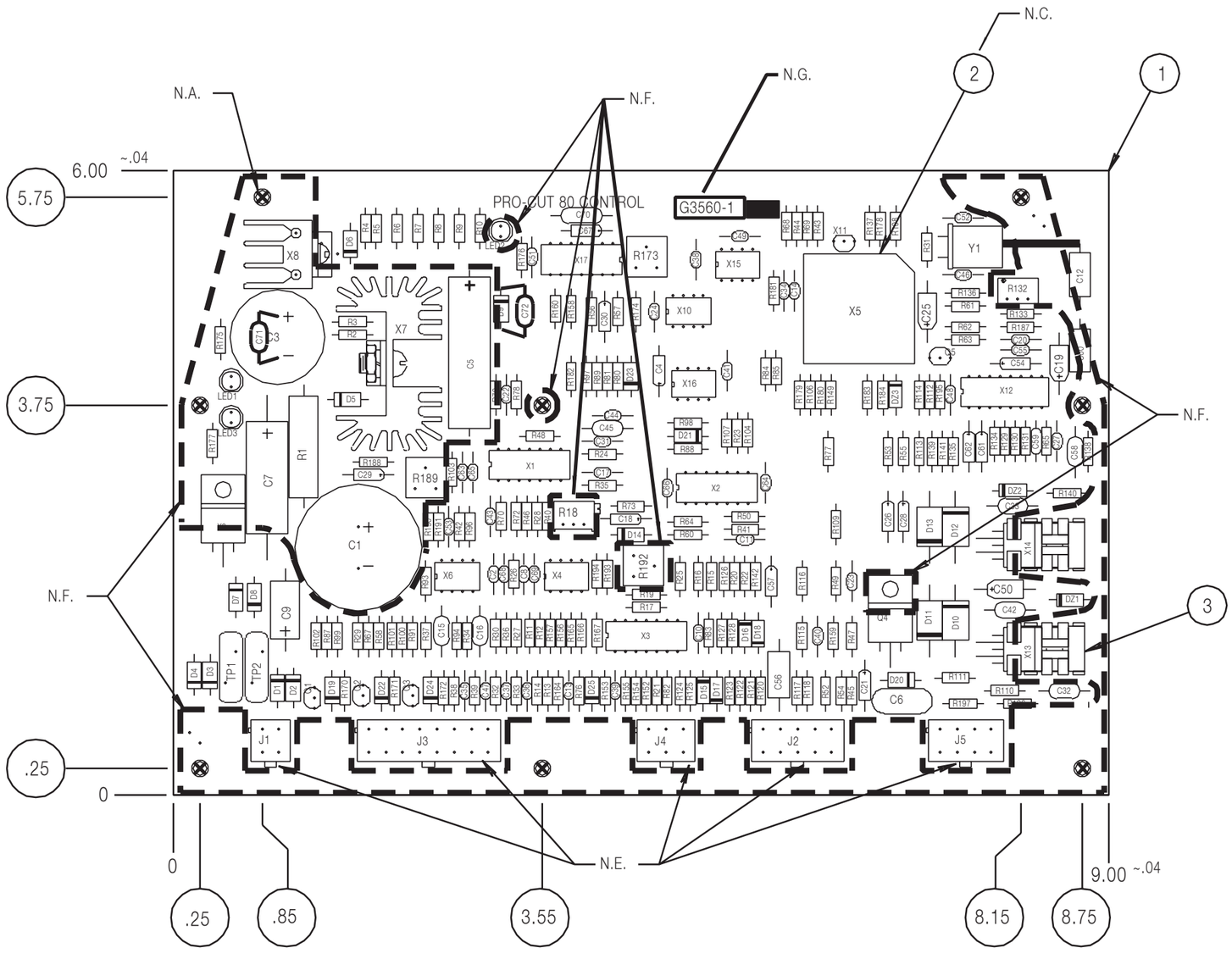
ITEM	REQ'D	PART NO.	DESCRIPTION
C1	1	S13490-92	3300/50
C2,C8,C10,C11,C13,C14,C17 C20,C23,C24,C31,C34,C35 C36,C37,C38,C39,C40,C41 C47,C49,C51,C53,C55,C63 C64,C65,C66,C68,C69	30	S16668-5	.022/50
C3	1	S13490-121	1000/35
C4,C18	2	S13490-63	.47/50
C5	1	S13490-71	100/50
C6	1	T11577-52	.0047 or .005/1400
C7	1	S13490-72	50/50
C9	1	S13490-93	27/35
C12,C60	2	S13490-126	.018/50V
C15,C16,C32,C33,C42,C58 C71,C72	8	S16668-11	.1/50
C19,C25,C50	3	S13490-25	4.7/35
C21,C26,C28,C30,C54,C57 C62,C67	8	S13490-42	1.0/35
C22,C43,C44	3	S16668-9	150pF/100
C27,C48	2	S16668-8	330pF/100
C29	1	S13490-135	1.0/50V
C45	1	S16668-4	2700pF/50
C46,C52	2	S16668-13	10pF/100
C56	1	S13490-108	.15/100
C59	1	S16668-3	100pF/100
C61	1	S13490-19	1.8/20
C70	1	S16668-10	4700pF/50
D1,D2,D3,D4,D5,D6,D7,D8,D9 D14,D19,D20,D22,D23,D24 D25	16	T12199-1	1N4004
D10,D11,D12,D13	4	T12705-37	1N5822 SCHOTTKY BARRIER DIODE
D15,D16,D17,D18	4	T12705-34	1N4936
D21	1	T12705-23	1N5818
DZ1,DZ2	2	T12702-19	1N4742A
DZ3	1	T12702-52	1N4733A
J1	1	S18248-4	HEADER
J2	1	S18248-10	HEADER
J3	1	S18248-16	HEADER
J4	1	S18248-6	HEADER
J5	1	S18248-8	HEADER
LED1,LED2,LED3	3	T13657-2	RED LED
Q1,Q2,Q3	3	T12704-68	2N4401
Q4	1	T12704-80	HEXFET TRANS. (SS)
Q5	1	T12704-69	2N4403
R1	1	T13165-16	1.0 OHM, 5W RESISTOR
R2,R46,R187	3	S19400-2671	2.67K 1/4W
R3,R30,R32,R33,R34,R36,R37 R38,R39	9	S19400-2430	243 1/4W
R4	1	S19400-30R1	30.1 1/4W
R5	1	S19400-6190	619 1/4W
R6	1	S19400-8251	8.25K 1/4W
R7,R190,R191,R193,R194	5	S19400-3921	3.92K 1/4W
R8	1	S19400-2001	2.0K 1/4W
R9,R15,R50,R64,R88,R103 R113	7	S19400-1001	1K 1/4W
R10,R42,R96	3	S19400-5110	511 1/4W
R11,R12,R13,R14	4	S19400-3320	332 1/4W
R16,R21	2	S19400-3322	33.2K 1/4W
R17,R23,R26,R27,R61,R62 R63,R68,R69,R81,R84,R93 R94,R104,R106,R108,R134 R138,R139,R154,R156,R158 R160,R164,R165,R166,R178 R179,R180,R181,R182	31	S19400-1002	10K 1/4W
R18	1	S24073-1	10K,1/2W,TRIMMER
R19,R53,R55,R57,R85,R149 R157	7	S19400-5111	5.11K 1/4W
R20,R22,R110,R111,R124 R125,R126,R127,R128,R142 R196,R197	12	S19400-10R0	10 1/4W
R24,R35	2	S19400-2210	221 1/4W
R25,R47,R49,R80,R89,R153 R183	7	S19400-1003	100K 1/4W
R28,R112,R115,R116,R117 R118,R133	7	S19400-3321	3.32K 1/4W
R29,R91,R102	3	S19400-8250	825 1/4W
R31	1	S19400-1004	1M 1/4W
R40	1	S19400-6191	6.19K 1/4W
R41,R60,R135,R184	4	S19400-1502	15K 1/4W
R43,R44,R45,R130,R136,R137 R170,R171,R172	9	S19400-4751	4.75K
R48	1	S19400-2802	28.0K 1/4W
R52,R54,R56	3	S19400-1000	100 1/4W
R58,R76,R99,R100	4	S19400-3741	3.74K 1/4W
R65,R129	2	S19400-2211	2.21K 1/4W
R67,R70,R87,R101	4	S19400-4752	47.5K 1/4W
R72,R195	2	S19400-1501	1.5K 1/4W
R73,R107	2	S19400-7681	7.68K 1/4W
R77,R82,R175,R177	4	S19400-1301	1.3K 1/4W
R78,R159	2	S19400-1211	1.21K 1/4W
R79,R83,R155,R167	4	S19400-2213	221K 1/4W
R97	1	S19400-8252	82.5K 1/4W
R98	1	S19400-2431	2.43K 1/4W
R109	1	S19400-6811	6.81K 1/4W
R114	1	S19400-5621	5.62K 1/4W
R120,R121,R122,R123	4	S19400-26R7	26.7 1/4W
R131	1	S19400-1212	12.1K 1/4W
R132	1	S16296-5	10K TRIMMER
R140,R141	2	S19400-2670	267 1/4W
R152	1	S19400-2002	20K 1/4W
R173	1	T10812-39	50K 1/2W TRIMMER
R174	1	S19400-6812	68.1K 1/4W
R176	1	S19400-4750	475 1/4W
R188	1	S19400-3922	39.2K 1/4W
R189,R192	2	T10812-68	1K 1/2W TRIMMER
TP1,TP2	2	T13640-15	15J
X1	1	S15128-16	IC-LT1014,LINEAR INTEGRATED CIRCUIT
X2	1	S15128-18	IC,33074A,OP-AMP,QUAD,HIGH-PERF
X3	1	S15128-4	IC,LM224,OP-AMP

CAPACITORS = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

3-19-99
G 3443-1B3

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

PC BOARD ASSEMBLY - CONTROL BOARD (CODE 10577 & 10578 ONLY)



ITEM			REQ'D	PART NO.	DESCRIPTION
C1	1	S13490-92	5	00/50	
C2,C8,C10,C11,C13,C14,C17	30	S16668-5		22/50	
C20,C23,C24,C31,C34,C35					
C36,C37,C38,C39,C40,C41					
C47,C49,C51,C53,C55,C63					
C64,C65,C66,C68,C69					
C3	1	S13490-121	1	00/35	
C4,C18	2	S13490-63		47/50	
C5	1	S13490-71	1	0/50	
C6	1	T11577-52	0	47 or .00	1400
C7	1	S13490-72	5	0/50	
C9	1	S13490-93	2	7/35	
C12,C60	2	S13490-126		.018/50V	
C15,C16,C32,C33,C42,C58	8	S16668-	11	.1/50	
C71,C72					
C19,C25,C50	3	S13490-25		4.7/35	
C21,C26,C28,C30,C54,C57	8	S13490-	42	1.0/35	
C62,C67					
C22,C43,C44	3	S16668-9		150pF/1	0
C27,C48	2	S16668-8		330pF/10	
C29	1	S13490-135	1	0/50V	
C45	1	S16668-4	2	700pF/50	
C46,C52	2	S16668-13		10pF/100	
C56	1	S13490-108		5/100	
C59	1	S16668-3	1	00pF/100	
C61	1	S13490-19	1	2/20	
C70	1	S16668-10	4	700pF/50	
D1,D2,D3,D4,D5,D6,D7,D8,D9	16	T12199-1	1	N4004	
D14,D19,D20,D22,D23,D24					
D25					
D10,D11,D12,D13	4	T12705-37	1	N5822	SCHOTTKY BARRIER DIODE
D15,D16,D17,D18	4	T12705-34	1	N4936	
DZ1	1	T12705-23	1	N5818	
DZ1,DZ2	2	T12702-19	1	N4742A	
DZ3	1	T12702-52	1	N4733A	
J1	1	S18248-4	HEADER		
J2	1	S18248-10	HEADER		
J3	1	S18248-16	HEADER		
J4	1	S18248-6	HEADER		
J5	1	S18248-8	HEADER		
LED1,LED2,LED3	3	T16857-2		RED LED	
Q1,Q2,Q3	3	T12704-68	2	N4401	
Q4	1	T12704-80	HEXFET TRANS. (SS)		
Q5	1	T12704-69	2	N4403	
R1	1	T13165-16	1.0	OHM, 5W	RESISTOR
R2,R46,R187	3	S19400-2671	2.67K	1/4W	
R3,R30,R32,R33,R34,R36,R37	9	S19400-2430	243	1/4W	
R38,R39					
R4	1	S19400-30R1	30.	1/4W	
R5	1	S19400-6190	619	1/4W	
R6	1	S19400-8251	8.25K	1/4W	
R7,R190,R191,R193,R194	5	S19400-3921	3.92K	1/4W	
R8	1	S19400-2001	2.0K	1/4W	
R9,R15,R50,R64,R88,R103	7	S19400-1001	1K	1/4W	
R113					
R10,R42,R96	3	S19400-5110	511	1/4W	
R11,R12,R13,R14	4	S19400-3320	332	1/4W	
R16,R21	2	S19400-3322	33.2K	1/4W	
R17,R23,R26,R27,R61,R62	31	S19400-1002	10K	1/4W	
R63,R68,R69,R81,R84,R93					
R94,R104,R106,R108,R134					
R138,R139,R154,R156,R158					
R160,R164,R165,R166,R178					
R179,R180,R181,R182					
R18	1	S24073-1	10K,1/2W,TRIMMER		
R19,R53,R55,R57,R85,R149	7	S19400-5111	5.11K	1/4W	
R157					
R20,R22,R110,R111,R124	12	S19400-10R0	10	1/4W	
R125,R126,R127,R128,R142					
R196,R197					
R24,R35	2	S19400-2210	221	1/4W	
R25,R47,R49,R80,R89,R153	7	S19400-1003	100K	1/4W	
R183					
R28,R112,R115,R116,R117	7	S19400-3321	3.32K	1/4W	
R118,R133					
R29,R91,R102	3	S19400-8250	825	1/4W	
R31	1	S19400-1004	1M	1/4W	
R40	1	S19400-6191	6.19K	1/4W	
R41,R60,R135,R184	4	S19400-153	15K	1/4W	
R43,R44,R45,R130,R136,R137	9	S19400-4751	4.75K		
R170,R171,R172					
R48	1	S19400-2802	28.0K	1/4W	
R52,R54,R56	3	S19400-1000	100	1/4W	
R58,R76,R99,R100	4	S19400-3741	3.74K	1/4W	
R65,R129	2	S19400-2211	2.21K	1/4W	
R67,R70,R87,R101	4	S19400-4752	47.5K	1/4W	
R72,R195	2	S19400-1501	1.5K	1/4W	
R73,R107	2	S19400-7681	7.68K	1/4W	
R77,R82,R175,R177	4	S19400-1301	1.3M	1/4W	
R78,R159	2	S19400-1211	1.21K	1/4W	
R79,R83,R155,R167	4	S19400-2213	221K	1/4W	
R97	1	S19400-8252	82.5K	1/4W	
R98	1	S19400-2431	2.43K	1/4W	
R109	1	S19400-6811	6.81K	1/4W	
R114	1	S19400-5621	5.62K	1/4W	
R120,R121,R122,R123	4	S19400-26R7	26.7	1/4W	
R131	1	S19400-1212	2.1K	1/4W	
R132	1	S16296-5	1K	TRIMMER	
R140,R141	2	S19400-2670	267	1/4W	
R152	1	S19400-2002	20K	1/4W	
R173	1	T10812-39	5K	1/2W	TRIMMER
R174	1	S19400-6812	68.1K	1/4W	
R176	1	S19400-4750	475	1/4W	
R188	1	S19400-3922	39.2K	1/4W	
R189,R192	2	T10812-68	1K	1/2W	TRIMMER
TP1,TP2	2	T13640-15	5J		
X1	1	S15128-16	IC,LT1014,LINEAR INTEGRATED CIRCUIT		
X2	1	S15128-18	IC,83074A,OP-AMP,QUAD,HIGH-PERF		
X3	1	S15128-4	IC,M224,OP AMP		

CAPACITORS = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

THIS SHEET CONTAINS PROPRIETARY INFORMATION OWNED BY THE LINCOLN ELECTRIC CO. AND IS NOT TO BE REPRODUCED, DISCLOSED OR USED WITHOUT THE EXPRESS PERMISSION OF THE LINCOLN ELECTRIC CO.

UNLESS OTHERWISE SPECIFIED TOLERANCE ON HOLE SIZES PER E2056
ON 3 PLACE DECIMALS IS ±.020
ON 2 PLACE DECIMALS IS ±.030
ON ALL ANGLES IS ± 2° A DEGREE
MATERIAL TOLERANCE (*) TO AGREE WITH PUBLISHED STANDARDS.

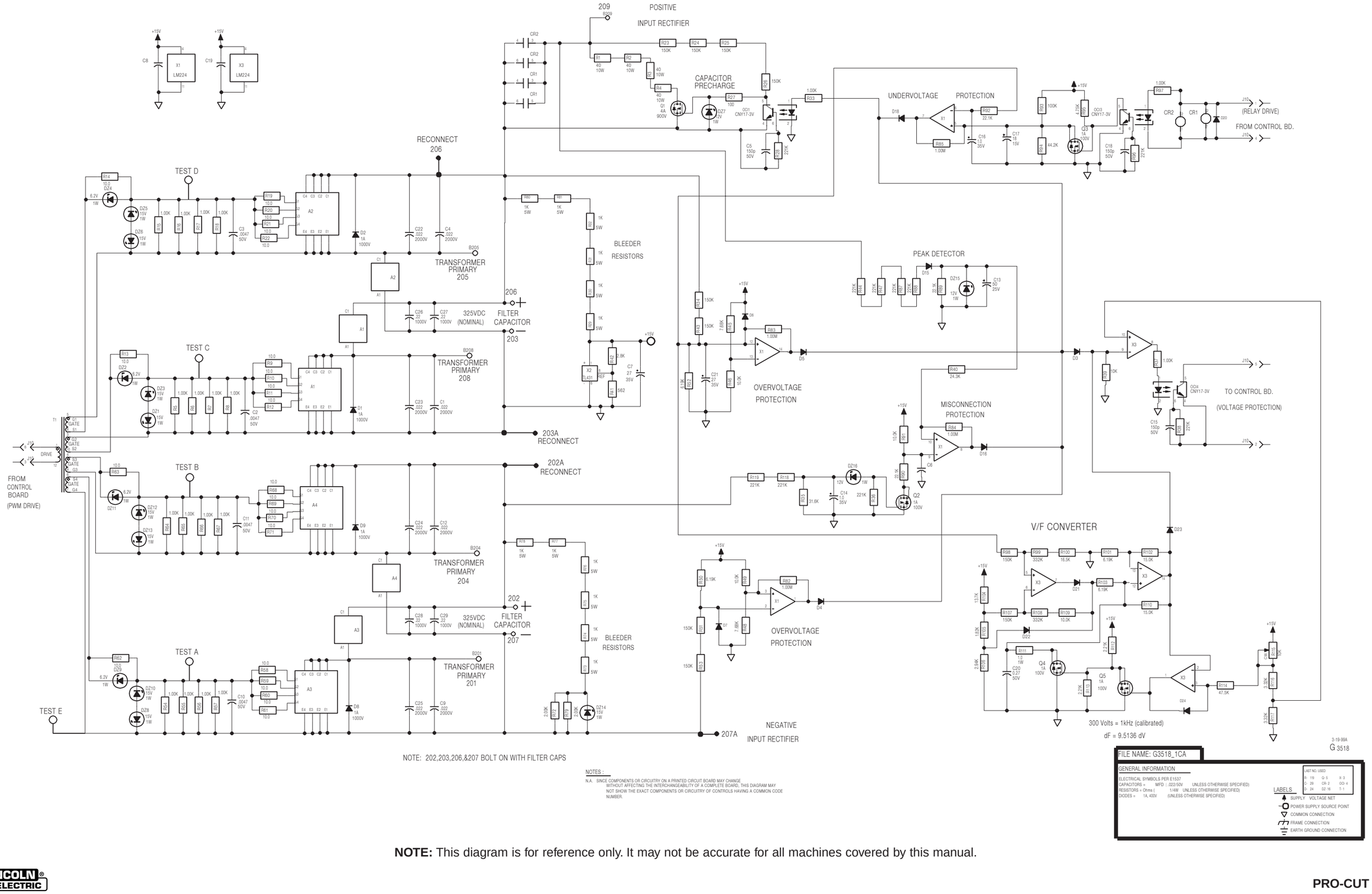
Dr.	Dr. Sh. No.				
DS					
2-10-99A					

THE LINCOLN ELECTRIC CO.
CLEVELAND, OHIO U.S.A.
SCALE FULL
DR DRS DATE 2-9-99 CHK REF. G3445-1 SUPS'D'G. SHT. G NO. 3560-1B3

EQUIP. INVERTER WELDERS
TYPE
SUBJECT CONTROL P.C. BD ASSEMBLY (CANADIAN)

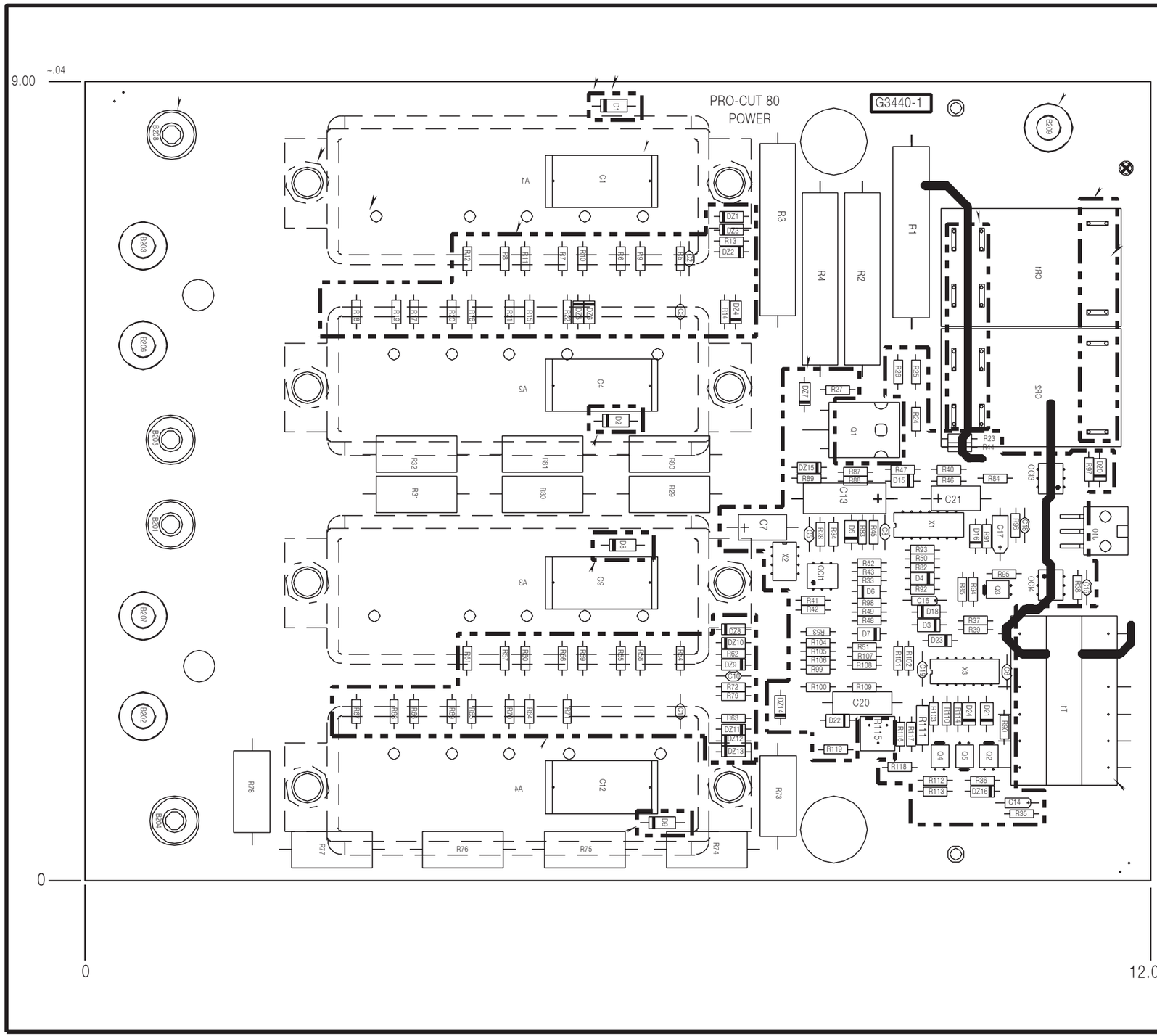
NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

SCHEMATIC - POWER PC BOARD



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - POWER BOARD

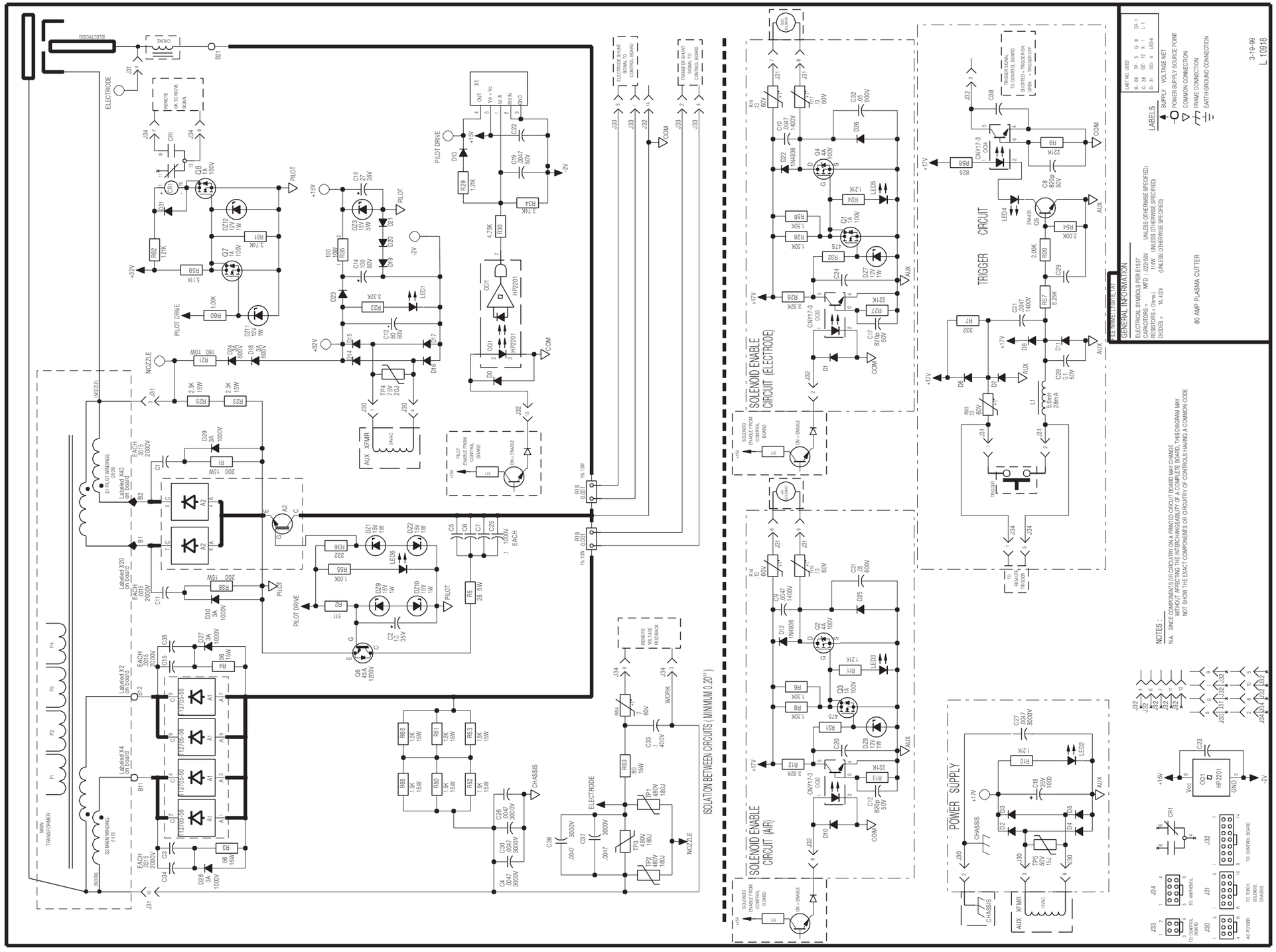


ITEM	REQ'D	PART NO.	DESCRIPTION
C1,C4,C9,C12	4	S20500-7	.047/1600
C2,C3,C10,C11	4	S16668-6	4700pF/50
C5,C15,C18	3	S16668-9	150pF/100
C6,C8,C19	3	S16668-5	.022/50
C7,C21	2	S13490-93	27/35
C13	1	S13490-83	50/25V
C14,C16	2	S13490-42	1.0/35
C17	1	S13490-39	18/15
C20	1	S13490-130	.27/50
CR1,CR2	2	S14293-18	DPST RELAY
D1,D2,D8,D9	4	T12705-44	DIODE 1000V/1A
D3,D4,D5,D6,D7,D15,D16,D18 D20,D21,D22,D23,D24	13	T12199-1	1N4004
DZ1,DZ3,DZ5,DZ6,DZ8,DZ10 DZ12,DZ13,DZ14	9	T12702-29	1N4744A
DZ2,DZ4,DZ9,DZ11	4	T12702-40	1N4735
DZ7,DZ15,DZ16	3	T12702-19	1N4742A
J10	1	S20351-6	HEADER
OCI1,OCI3,OCI4	3	S15000-22	OPTO ISOLATOR
Q1	1	T12704-75	FET (SS)
Q2,Q3,Q4,Q5	4	T12704-73	IC PKG MOSFET (SS)
R1,R2,R3,R4	4	S24376-2	40/10W
R5,R6,R7,R8,R15,R16,R17 R18,R33,R37,R54,R55,R56 R57,R64,R65,R66,R67,R97	19	S19400-1001	1K 1/4W
R9,R10,R11,R12,R13,R14,R19 R20,R21,R22,R58,R59,R60 R61,R62,R63,R68,R69,R70 R71	20	S19400-10R0	10 1/4W
R23,R24,R25,R26,R34,R43 R51,R53,R98,R107	10	S19400-1503	150K 1/4W
R27	1	S19400-1000	100 1/4W
R28,R36,R38,R44,R47,R87 R88,R96,R118,R119	10	S19400-2213	221K 1/4W
R29,R30,R31,R32,R73,R74 R75,R76,R77,R78,R80,R81	12	T14648-19	1K 5W
R35	1	S19400-3162	31.6K 1/4W
R39,R46,R49,R91,R109	5	S19400-1002	10K 1/4W
R40	1	S19400-2432	24.3K 1/4W
R41	1	S19400-5620	562 1/4W
R42	1	S19400-2801	2.8K 1/4W
R45,R48,R94	3	S19400-7681	7.68K 1/4W
R50,R52,R101,R103	4	S19400-6191	6.19K 1/4W
R72,R79	2	S19400-2001	2.0K 1/4W
R82,R83,R84,R85	4	S19400-1004	1M 1/4W
R89,R90,R92	3	S19400-2212	22.1K 1/4W
R93	1	S19400-1822	18.2K 1/4W
R95	1	S19400-4751	4.75K
R99,R108	2	S19400-3323	332K 1/4W
R100	1	S19400-1652	16.5K 1/4W
R102,R110	2	S19400-1502	15K 1/4W
R104	1	S19400-1372	13.7K 1/4W
R105	1	S19400-1821	1.82K 1/4W
R106	1	S19400-2941	2.94K 1/4W
R111	1	T12300-78	1 WATT 1 OHM 1% RESISTOR
R112,R113	2	S19400-2211	2.21K 1/4W
R114	1	S19400-4752	47.5K 1/4W
R115	1	T10812-41	10K 1/2W TRIMMER
R116,R117	2	S19400-3321	3.32K 1/4W
T1	1	S13000-46	TRANSFORMER
X1,X3	2	S15128-4	IC,LM224,OP-AMP
X2	1	S15128-10	IC,431,VOLTAGE REF.

CAPACITORS = MFD/VOLTS
RESISTORS = OHMS

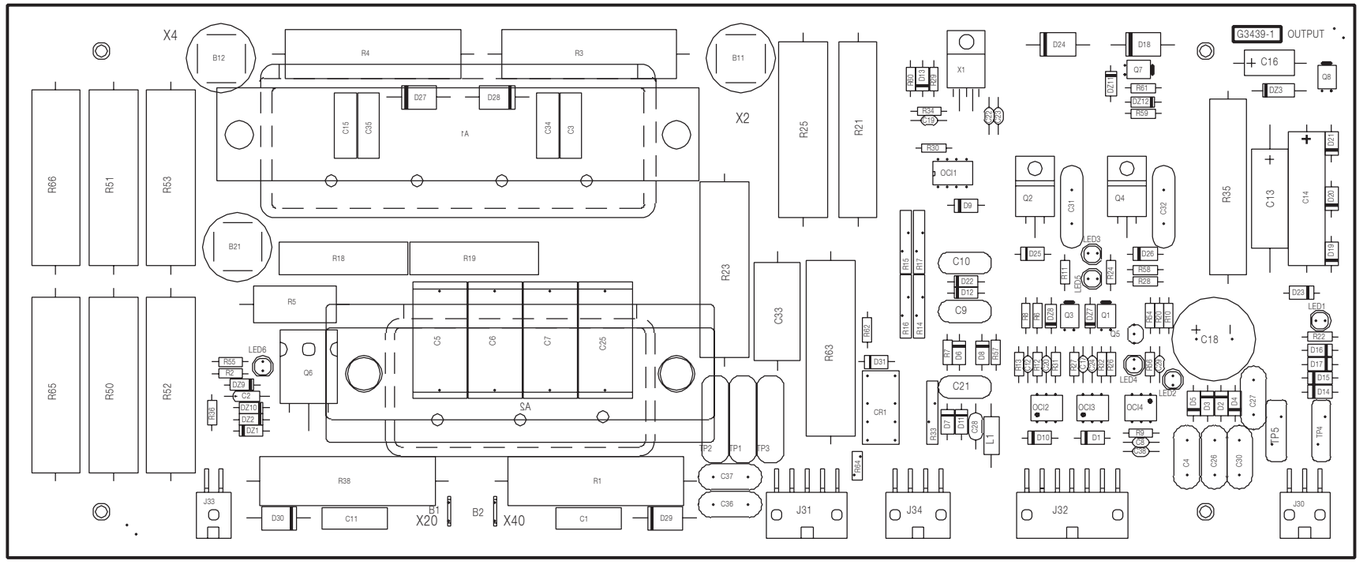
NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

SCHEMATIC - OUTPUT PC BOARD



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - OUTPUT BOARD



ITEM	REQ'D	PART NO	IDENTIFICATION
C1,C3,C11,C15,C34,C35	6	S20500-5	.0015/2000V
C2	1	S13490-42	1.0/35
C4,C26,C27,C30,C36,C37	6	T11577-58	.0047/3000V
C5,C6,C7,C25	4	S20500-1	.1/1000
C8,C12,C17	3	S16668-7	820pF/50
C9,C10,C21	3	T11577-52	.0047 or .005/1400
C13	1	S13490-72	
C14	1	S13490-71	
C16	1	S13490-93	
C18	1	S13490-121	
C20,C22,C23,C24,C29,C38	6	S16668-5	022/50
C28	1	S16668-11	1/50
C31,C32	2	T11577-46	.05/600V
C33	1	T11577-57	0.1/400
CR1	1	S13929-10	RELAY,DPDT,24VDC
D10,D11,D13,D14,D15,D16 D17,D19,D20,D21,D23,D25 D26,D31	2	T12705-34	1N4936
D12,D22	2	T12705-50	DIODE
D18,D24	4	T12705-46	1000V/3AMP DIODE
D27,D28,D29,D30	4	T12702-29	1N4744A
DZ1,DZ2,DZ9,DZ10	1	T12702-23	1N5352B
DZ3	4	T12702-19	1N4742A
DZ7,DZ8,DZ11,DZ12	1	S20351-6	HEADER
J30	1	S20351-10	RT. ANGLE HEADER
J31	1	S20351-14	HEADER
J32	1	S20351-4	HEADER
J33	1	S20351-8	HEADER
J34	1	T12218-2	5.6mH
L1	2	T13857-2	RED LED
LED1,LED2	4	T13857-3	GREEN LED
LED3,LED4,LED5,LED6	1	S15000-26	OPTOCOUPLER,LOGIC-OUT
OCI1	3	S15000-10	OPTO ISOLATOR
OCI2,OCI3,OCI4	4	T12704-73	IC PKG MOSFET (SS)
Q1,Q3,Q7,Q8	2	T12704-80	HEXFET TRANS. (SS)
Q2,Q4	1	T12704-68	2N4401
Q5	1	T12704-86	TRANSISTOR,IGBT,1200V,45A
Q6	2	T12300-47	15 W 200 OHM RESISTOR
R1,R38	1	S19400-5110	511 1/4W
R2	2	T12300-66	15W / 56 OHM PWR RESISTOR
R3,R4	1	T14648-2	25 5W
R5	4	S19400-1501	1.5K 1/4W
R6,R8,R28,R58			
R9,R13,R27	3	S19400-2213	221K 1/4W
R10,R11,R24,R29,R62	5	S19400-1211	1.21K 1/4W
R12,R26	2	S19400-3921	3.92K 1/4W
R14,R15,R16,R17,R33	5	S18380-3	THERMISTOR,PTC,0.08-0.19 OHMS,1.85A
R18,R19	2	S23995-1	SHUNT RESISTOR,.001 OHM,4W
R20,R54	2	S19400-2001	2.0K 1/4W
R21	1	T14649-11	160/10W
R22	1	S19400-3321	3.32K 1/4W
R23,R25	2	T14650-4	15W ,2500 OHM RESISTOR
R30	1	S19400-4751	4.75K
R31,R32	2	S19400-4750	475 1/4W
R34,R61	2	S19400-3741	3.74K 1/4W
R35	1	T14649-4	100 10W
R50,R51,R52,R53,R65,R66	6	T14650-1	1500 OHMS, 15 W. RESISTOR
R55,R60	2	S19400-1001	1K 1/4W
R56	1	S19400-8250	825 1/4W
R57	1	S19400-8251	8.25K 1/4W
R59	1	S19400-5111	5.11K 1/4W
R63	1	T14650-2	80 15W
R64	1	S18380-9	THERMISTOR,PTC,10 OHMS,400MA
TP1,TP2,TP3	3	T13640-20	480V/180J MOV
TP4	1	T13640-9	20J
TP5	1	T13640-15	15J
X1	1	S15018-19	IC,DRIVER,FET,6A

CAPACITORS = MFD/VOLTS
RESISTORS = OHMS

3-19-99
G3439-1

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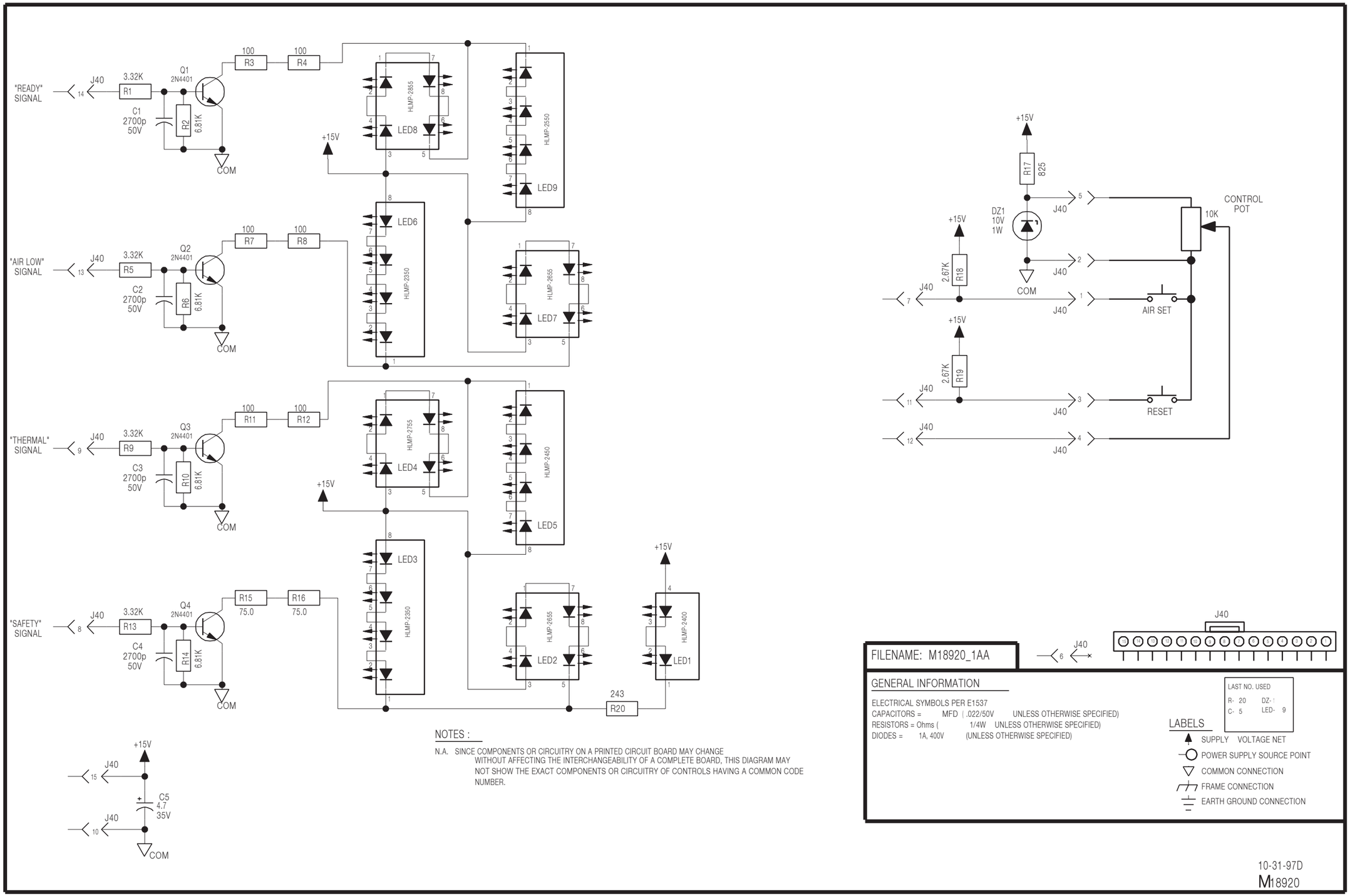
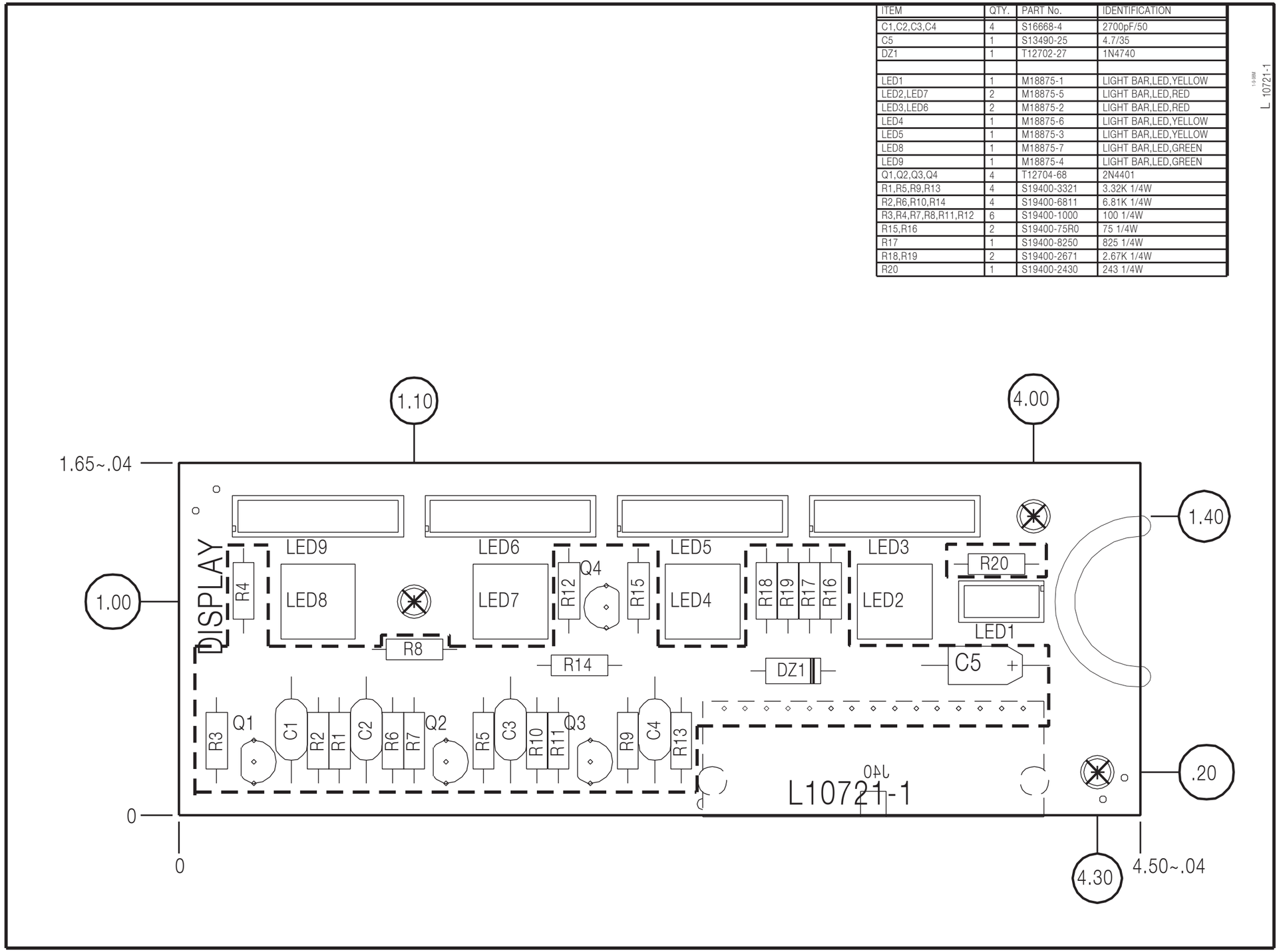
SCHEMATIC - DISPLAY PC BOARD



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - DISPLAY BOARD

ITEM	QTY.	PART No.	IDENTIFICATION
C1,C2,C3,C4	4	S16668-4	2700pF/50
C5	1	S13490-25	4.7/35
DZ1	1	T12702-27	1N4740
LED1	1	M18875-1	LIGHT BAR,LED,YELLOW
LED2,LED7	2	M18875-5	LIGHT BAR,LED,RED
LED3,LED6	2	M18875-2	LIGHT BAR,LED,RED
LED4	1	M18875-6	LIGHT BAR,LED,YELLOW
LED5	1	M18875-3	LIGHT BAR,LED,YELLOW
LED8	1	M18875-7	LIGHT BAR,LED,GREEN
LED9	1	M18875-4	LIGHT BAR,LED,GREEN
Q1,Q2,Q3,Q4	4	T12704-68	2N4401
R1,R5,R9,R13	4	S19400-3321	3.32K 1/4W
R2,R6,R10,R14	4	S19400-6811	6.81K 1/4W
R3,R4,R7,R8,R11,R12	6	S19400-1000	100 1/4W
R15,R16	2	S19400-75R0	75 1/4W
R17	1	S19400-8250	825 1/4W
R18,R19	2	S19400-2671	2.67K 1/4W
R20	1	S19400-2430	243 1/4W



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SVM ERROR REPORTING FORM

We need to know if there are errors in our manuals. We also value any suggestions as to additional tests or procedures that would make this SVM a better tool for you.

If you discover new or different “Problems or Symptoms” that are not covered in the three column troubleshooting chart, please share this information with us. Please include the machine’s code number and how the problem was resolved.

Thank You,
Technical Services Group
Lincoln Electric Co.
22801 ST. Clair Ave.
Cleveland, Ohio 44117-1199

FAX 216-481-2309

SVM Number _____

Page Number if necessary_____

Your Company_____

Your Name_____

Please give detailed description below:

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